consulting engineer

October 1954

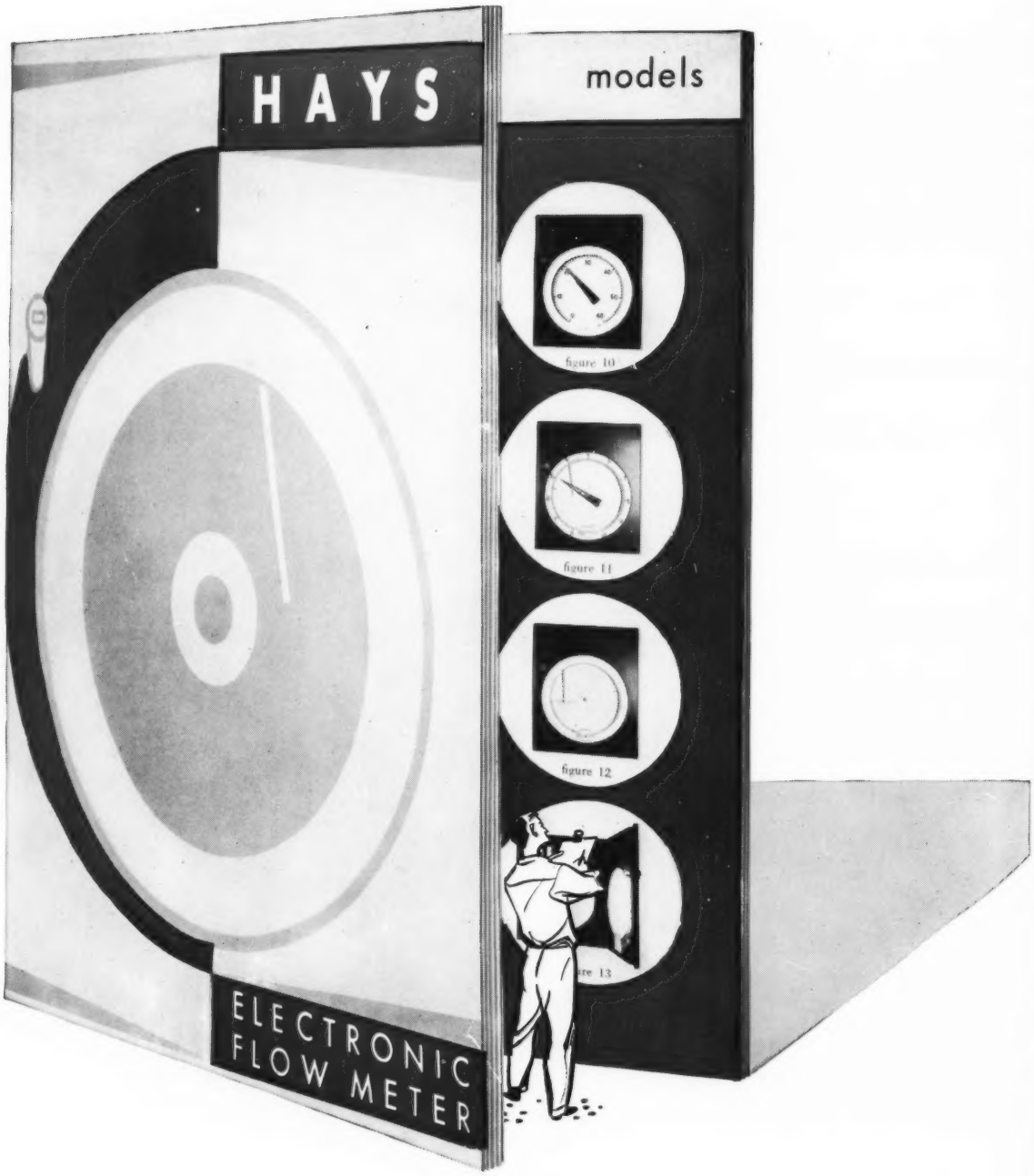
. . . . . *Telemachus takes off*

Horatio Alger Story

MICHAEL BAKER, JR., at the age of 42, is the head of one of the country's largest and fastest growing consulting organizations. Despite his youth, he has established an international reputation for tackling any and all kinds of engineering jobs and fulfilling his contracts with professional polish.

—Continued on page 6

The Consulting Engineer's Professional Magazine



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VOLUME 4

NUMBER 4

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consulting engineer ®

OCTOBER 1954

FEATURES

DEPARTMENTS

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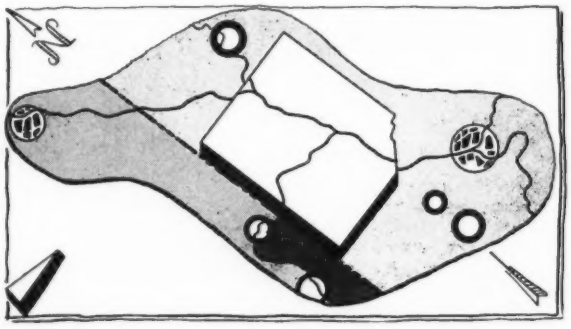
Horatio Alger Story

—Starts on Front Cover

The versatility of his organization and its ability to "turn on a dime" is an important factor in his success.

Baker had tough sledding when he first hung out his consulting shingle 14 years ago at the age of 28. His youthfulness was against him from the start, but under the pressure of the war emergency and the critical shortage of engineers, he finally was given an opportunity to show what he could do.

A subcontract from a Pittsburgh company for a hurry-up survey of a defense property near Paducah, Kentucky was handled so quickly and efficiently by Baker's crews, that he drew the attention of the U.S. Corps of Engineers in Washington and in the District Offices. Before long, Michael Baker, Jr., Inc., was a full-blown "war baby" in defense work.



During the war, he had built up an organization of competent engineers with a proven record of accomplishment. When the war ended and Baker had to sink or swim in the stream of competition, he decided to go out and find new opportunities for his talent. What he lacked in years and experience, he made up in hustle and persistence, and, more important, performance, once he got the job.

For example, his tenacity finally convinced state highway planners and the ultra-conservative banks and investment houses that issue the bonds and put up the money, that his firm had the ability and know-how necessary for master planning, design, and supervision of construction. Currently, Baker is consultant design engineer on about a dozen superhighway and toll road projects, including a portion of the northeast extension of the Pennsylvania Turnpike; the Circumferential Expressway circling Washington, D.C.; and the $20 million Fort Pitt tunnel which will complete Pittsburgh's Parkway West. Baker's firm is recognized as one of the top highway planners in the country.

The recognition is overdue. The facts are that in 14 years Baker has built an organization of over 900 people—about 600 of whom are engineers—that in 1954 will do a gross billing of almost $9 million. He has continued to diversify his "war baby" consulting firm into many new fields and enterprises without losing a stride. Every job he has done has been completed to the satisfaction of the client and within the terms of the original contract. His projects range from the Nike rocket installations around Pittsburgh to responsibility for the irrigation and agricultural developments in Saudi Arabia and Jordan.

Baker has won recognition outside his profession too. Earlier this year, he received the 1954 Horatio Alger Award for outstanding achievement and last month he was elected to the national Young President's Organization.

In his second floor offices in the Baker Building in Rochester, Pa., Mike Baker often reflects on the difficulties he had to overcome because of his youth. "I just wish that the engineering community would be a little less conservative and a little more human. I wish that it would lean a bit more towards extending genuine help and encouragement to our young men who have shown ability, talent, and enthusiasm. There are enough legitimate obstacles in competing in the professional world without the added burden of answering the old bromides as 'you're too young' or 'you don't have enough experience' or 'you've never done this work before'.

"It is encouraging to note that some of the city fathers; municipal, state, and federal officials; officers of banks and investment houses; are realizing that a consulting engineer's prestige or reputation, carried along after that man is dead or has retired and others are running his business, is no longer sufficient justification for awarding contracts or authorizing financial commitments. Every consulting engineering firm should be evaluated in terms of its present staff and their abilities to produce.

"There are many, many opportunities in this country that need only the initiative, talent, and enterprise of fresh, young blood to uncover and exploit the possibilities. Lip service is not enough. Our engineering firms, engineering societies, public and private officials must give concrete evidence that they are prepared to help give recognition, jobs, and encouragement to the up-and-coming consultants if this development is to continue to grow.

"As for Michael Baker, Jr., Inc., we are going to keep on showing that we have faith in the young people in our organization by giving them the opportunity to try new ideas, go after new projects, and express their potential to the maximum. Our day-to-day activities are our best expression of faith in the engineering profession, its ethics, and public responsibilities."

And Baker concludes, "there is one advantage in fighting the age handicap, time is on your side!" ▲ ▲

not in the book!

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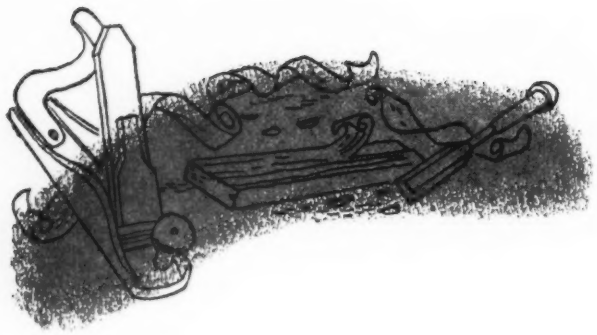

SCRAPS & SHAVINGS

ANY ENGINEER with half an eye aimed away from the drawing board should know that the public does not consider him a professional man. He can meet with other engineers and discuss fees, bidding practice, codes of ethics, and engineering education, but the warm rays of professionalism shining down on the group are invisible to the general public.

A full page advertisement was recently carried in many daily newspapers under the heading, "I am an Engineer." It showed a fine looking young man neatly dressed in overalls. The commercial artist (who presumably knows something about the subject he is depicting) saw the engineer as a man in overalls, and the advertising account executive (who knows everything about everything) approved the impersonation. We cannot deny that the general public thinks of the engineer as a mechanic in overalls or a surveyor in puttees. We may be professional men when we talk to ourselves, but we are manual laborers when we step onto the street.

We all want professional recognition.

We have not faced this problem squarely. Some of us have denied its very existence, blindly assuming that the public already considers the engineer a professional man. Others among us have failed to analyze the factors involved in the problem.

First, we are handicapped by history. Medicine, law, and the ministry are ancient in origin and heavy with tradition. For centuries the medical doctor, the barrister, and the clergyman have been accepted as learned men qualified to give help and advice to the layman. Contrast this with the engineer, whose very title was unknown outside of the military just 150 years ago. Rensselaer Polytech awarded the first engineering degrees in the United States in 1834. In England, the engineering degree is of even more recent origin. We must recognize this lack of ancient tradition as a very real handicap in being accepted by the public as professional men.

Next, there is the lack of definition of the engineer's field of activity. The public must not be blamed too severely for thinking of the engineer as a mechanic or a construction worker, for the association has been close. During most of the 19th century, industrial progress was largely the result of invention by self-taught mechanics, with whom the public has confused the engineer. Watt was a mechanic. Edison was no electrical engineer; he was a self-taught inventive genius. But the association of these men with engineering is strong in the public mind.

Another factor is educational level. Today, the Bachelor of Science in Engineering degree is much more common than the professional degree. We must recognize that all the other professions require more than a Bachelor's degree for graduation. Engineering, to be recognized as a profession, must soon accept the fact that at least 5 and perhaps 6 years should be required before a student can leave college and refer to himself as an engineer.

Then there is the question of registration. Considerably less than half of the graduate engineers today are registered with any state. Doctors and lawyers must be registered to call themselves doctors and lawyers and to practice. Eventually, the same requirements must be imposed upon engineers.

Method of compensation has much to do with our lack of recognition. Approximately three percent of the engineers in this country work on a fee basis. This is the reverse of the situation with doctors and lawyers. If we are to have professional recognition, the percentage of engineers in private practice must be increased.

Still another requirement is a recognized and unified engineering organization. Without in any way giving up the many important societies dealing with specific branches of engineering, we must have an engineers' equivalent of the American Medical Association and American Bar Association.

Last, we must have one accepted code of ethics—a code that is taught in all engineering schools and one that is observed by all engineers. The code must be enforceable in that any engineer who acted outside of the code could be removed from the rolls of the society and his registration revoked.

Until we have understood all of these requirements for professional recognition and have acted upon those requiring action, we will remain, in the public eye, "men in overalls." ▲▲

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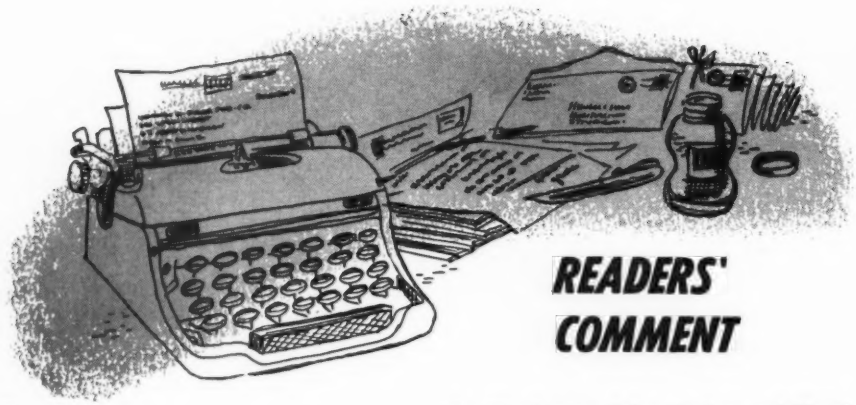


READERS' COMMENT

Singular Error

Page 38 of the September issue shows Mr. Lyles an "alumni" of Clemson.

Let's hereafter designate an individual as an alumnus. It does not detract from the excellency of the article but does look a little queer when it falls into the hands of, say a lawyer or clergyman.

J. Ambler Johnston
Carneal and Johnston

● JUDGING BY LETTERS RECEIVED, IT ALSO LOOKS QUEER TO ENGINEERS.

Developing Code

We wish to take this opportunity to tell you that your publication has carried articles which are of great interest to us. At the present time I am President of the Chicago Association of Consulting Engineers, and you have published articles by various men that we have discussed at some of our recent meetings. Personally I have gone so far as to contact these writers, in some instances people whom I would not have heard about except through your publication.

At present the Chicago Association of Consulting Engineers is developing a "Code of Trade Practices" in collaboration with the various trades' groups and architects in Chicago. We have found in some of your issues, articles by engineers telling of similar problems. It was the authors of these articles whom I personally contacted.

All I can say is that I look forward to each new issue and not only have I found this of extreme interest and value, but the personnel of my organization have also expressed appreciation for the informative articles in each issue.

Edward J. Wolff
Consulting Engineer

Hiring Young Engineers

There has come to my attention an article in your August issue entitled, "How You Can Compete for Top Talent Graduating Engineers," by Professor John F. Lee, of North Carolina State College.

The subject of Prof. Lee's article is of great personal interest and importance to me, because I am a Consulting Engineer and have been for many years, and because I assume that our office with approximately thirty employees would be included in the definition of "small consulting engineering office."

Included in the article are these three statements: "In some instances the company is looking for a draftsman and not an engineer," and "No matter how an individual feels about the importance of drafting experience, it is a simple fact that the engineering schools no longer produce draftsmen," and then, "The interviewer would be well advised to seek that type of personnel elsewhere." The inclusion of these statements and their implications is, to put it mildly, a fundamental criticism of and contradiction to the accepted practices of almost all professional engineering and architectural firms. Therefore, the opinions expressed by the author of the article must be considered not primarily as suggestions for improvement of "recruiting techniques" but as a new "recruiting technique" based upon radical changes in the functioning of the professional engineer's office and the service which he renders his client.

It is difficult for offices like ours to label individuals as "Engineers," "Engineering Draftsmen," or "Draftsmen" because in our estimation, and what is more important in the practice of our profession, drafting is *not a trade, it is a tool,* the proper use of which enables an engineer to present his thoughts, ideas, and decisions to an estimator or mechanic in such a manner that the estimator or mechanic can with minimum lost motion obtain a clear understanding of the required end-product and the method of producing same. In such an office, drafting in itself is of no consequence, but an engineer without well developed drafting ability is like an author with a limited vocabulary or a musician without an instrument. The ideas, the knowledge, the ability, may be present, but the method of communication is lacking. If you tell us that the "engineer" should communicate his thoughts and designs to a draftsman who should, in turn, translate them into a set of drawings for use in estimating and constructing, it seems to me that the draftsman must then become an engineer also, in order to be able to interpret the thoughts of the engineer who is designing, but can't do drafting. It would appear that we are being told to look to the engineering schools for the first engineer and then "look elsewhere" for the draftsman who must also be an engineer. If, on the other hand, we are advised that the engineering graduate will prepare "rough sketches" for use by the draftsman, we are faced with the fact that generally speaking, intelligible rough sketches are made only by men who have served an apprenticeship on the drafting board and that without the ability to make a clear mechanical drawing it is difficult to produce free-hand sketches suitable for a draftsman's use.

In summary, I am disturbed by the article entitled "How You Can Compete for Top Talent Graduating Engineers," not so much because of the criticisms of our recruiting techniques, as because of the problem of determining what to do with a graduate engineer who can't draw, if by revising our techniques we are able to recruit him.

It is believed that the article and its implications are important enough to the professional engineer and to the engineering schools that further consideration is indicated.

Leo L. Landauer
Landauer and Shafer

Subject for Debate

Having looked through several issues of CONSULTING ENGINEER, I would like to congratulate the publishers on doing an excellent job.

I cannot resist a comment about your opinions expressed in "Scraps & Shavings" in the September issue. The points are certainly well taken, but I wonder if you considered integration of private steam power with public hydro equipment. Maybe in the current condition of tempers in this matter, such would not be possible. Historically, the major public power projects have been hydro, and the government's entry of the steam field on a large scale is

certainly a subject for much debate. Don't misunderstand me, I believe your comments are accurate, but I believe the problem goes deeper than you have indicated.

Could you possibly have stretched your point a little to get in a credit for our old professor in your mention of Morse's *Power Plant Engineering?*

J. W. Lapsley, Jr.
Celanese Corporation of America

Pounds of Dead Flesh

The announcement which appeared in Mr. E. F. MacDonald's Economic News Notes (CONSULTING ENGINEER, August, 1954, page 16) that two Cleveland "engineering" firms, who apparently own some Engineers, are now renting them by the hour to anyone who wants to lease them, like the machines offered in the two succeeding paragraphs by several other companies, is shocking and disheartening to any engineer who believes that engineering is a learned profession, and who is working and contributing to the building of his profession.

Is an engineer a commodity to be bought and sold, or rented like so many pounds of dead flesh in a butcher shop or fish in the market? How ruthless and shameless can the exploitation of engineers by "business men" and not infrequently, by other engineers, become?

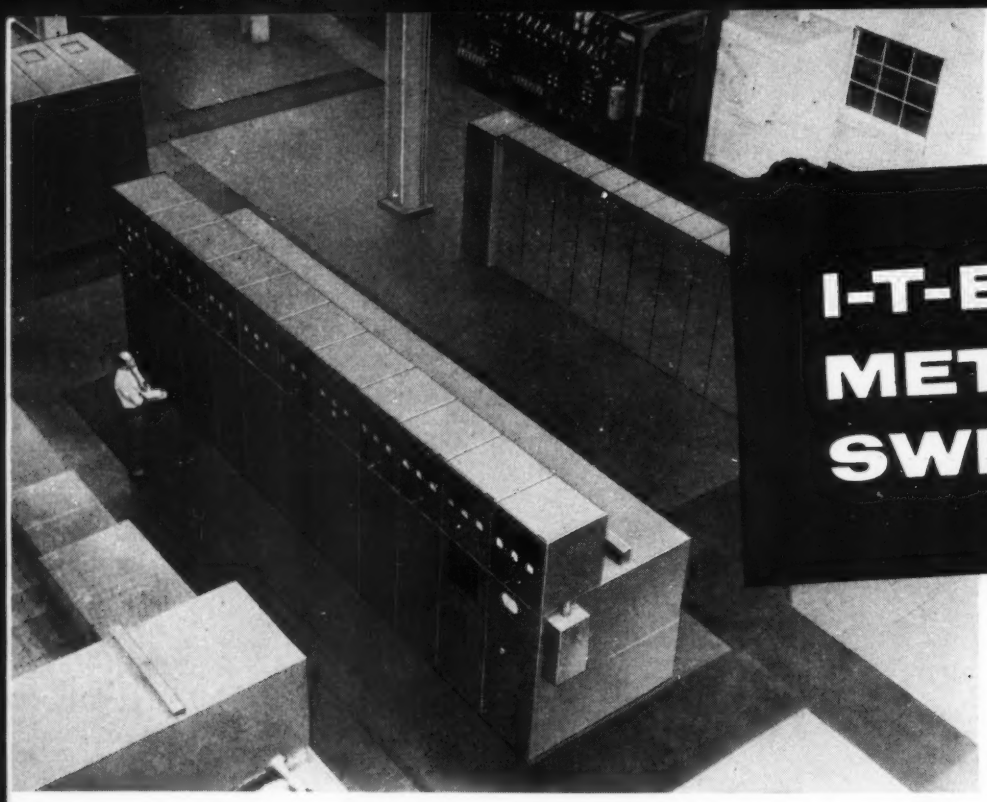
There are of course occasions when consulting engineers or their employees must work in the plants or offices of their clients, and I have worked under these conditions myself, but this offer to rent human beings is nauseating.

On another page (10) of the same issue you deplore editorially the organization of engineers into unions of any kind. Yet in view of the unethical and brazen commercialism of which engineers are so commonly victims, and of which the rental of engineers is an example, what can engineers do? They are being driven into the arms of unions by their exploiters—no one else.

Engineers should refuse to allow themselves to be rented out. They should work directly for their clients or employers. They need no middle men of any kind.

This letter is not written in criticism of your magazine or your columnists. On the contrary, I like your magazine very much, and make time to read it. You are to be complimented for exposing this nefarious rental practice.

Leonard Lasky
Professional Engineer



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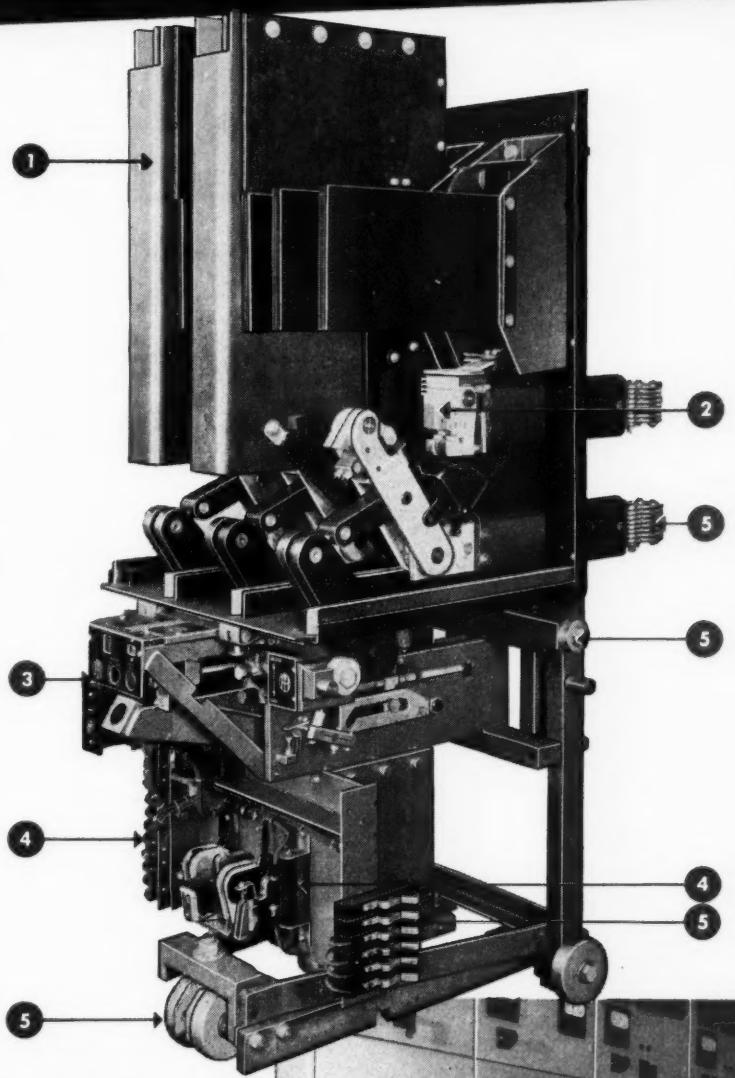

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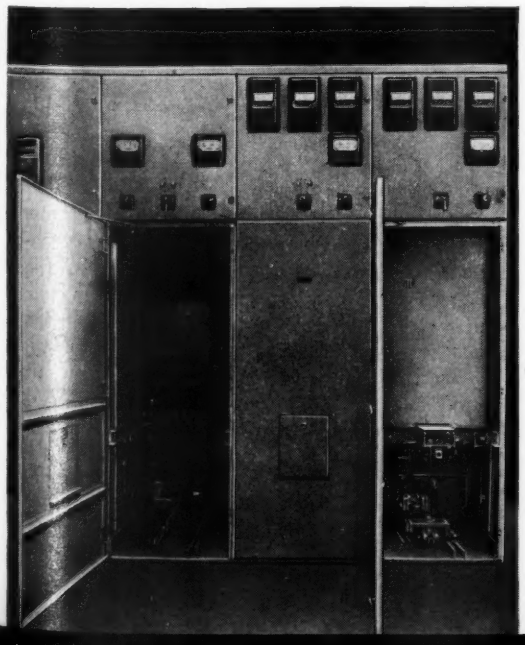

TO TEST BREAKER quickly and safely operator works through small auxiliary door—from *outside* compartment. Other safety features include complete interlocking of breaker operation, segregation of circuit wiring, proper venting of arc gases, and utilization of correct insulation materials.

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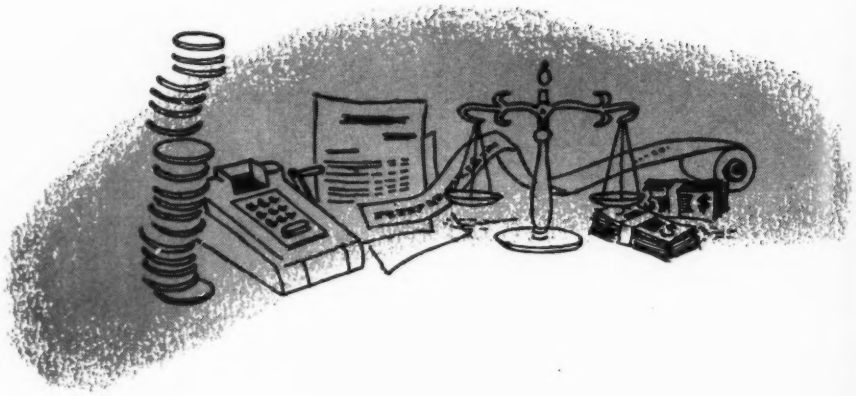
ECONOMIC NEWS NOTES

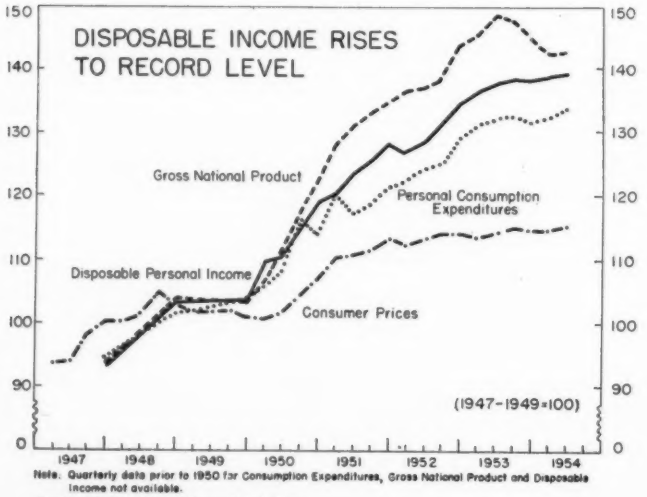


E. F. Mac Donald
INDUSTRIAL ECONOMIST

LESS BUT MORE—Despite a decline in budgeted defense expenditures, the military forces will increase their orders and contracts for goods and construction in fiscal 1955. Compared with a little over $9 billion of orders placed in fiscal 1954, the total is expected to rise to at least $16 billion this year. The increase should be a boon to companies that have been hard pressed to keep defense plants operating at satisfactory levels. Recent competition for defense orders has occasionally wiped out profit margins and frequently reduced them to very small proportions.

OUNCE OF PREVENTION—In view of the 17-fold increase in large-loss fires in the metalworking industry since 1942, the National Board of Fire Underwriters has issued a 57-page study of fire hazards and safeguards for metalworking plants. The survey explains that a more important factor than the many safety factors that have been introduced in recent years is the continuation of old fire causes in a more pronounced form.

UNDERLYING STRENGTH—Industry is betting heavily that consumer buying of autos and household appliances and furnishings will step up noticeably this fall. Early in September there were signs that consumers were spending more freely, but the big, significant test waits on the appearance of the new-model cars in the last quarter of this year. A very important point here is the fact that consumers as a group fared very well during the 1953-54 recession. As shown on the chart, disposable personal income (income after taxes) continued to rise despite the decline in the total national output of goods and services. The significance of this rise was enhanced by the remarkable stability of consumer prices.



Note: Quarterly data prior to 1950 for Consumption Expenditures, Gross National Product and Disposable Income not available.
Source: U. S. Department of Commerce and Labor.

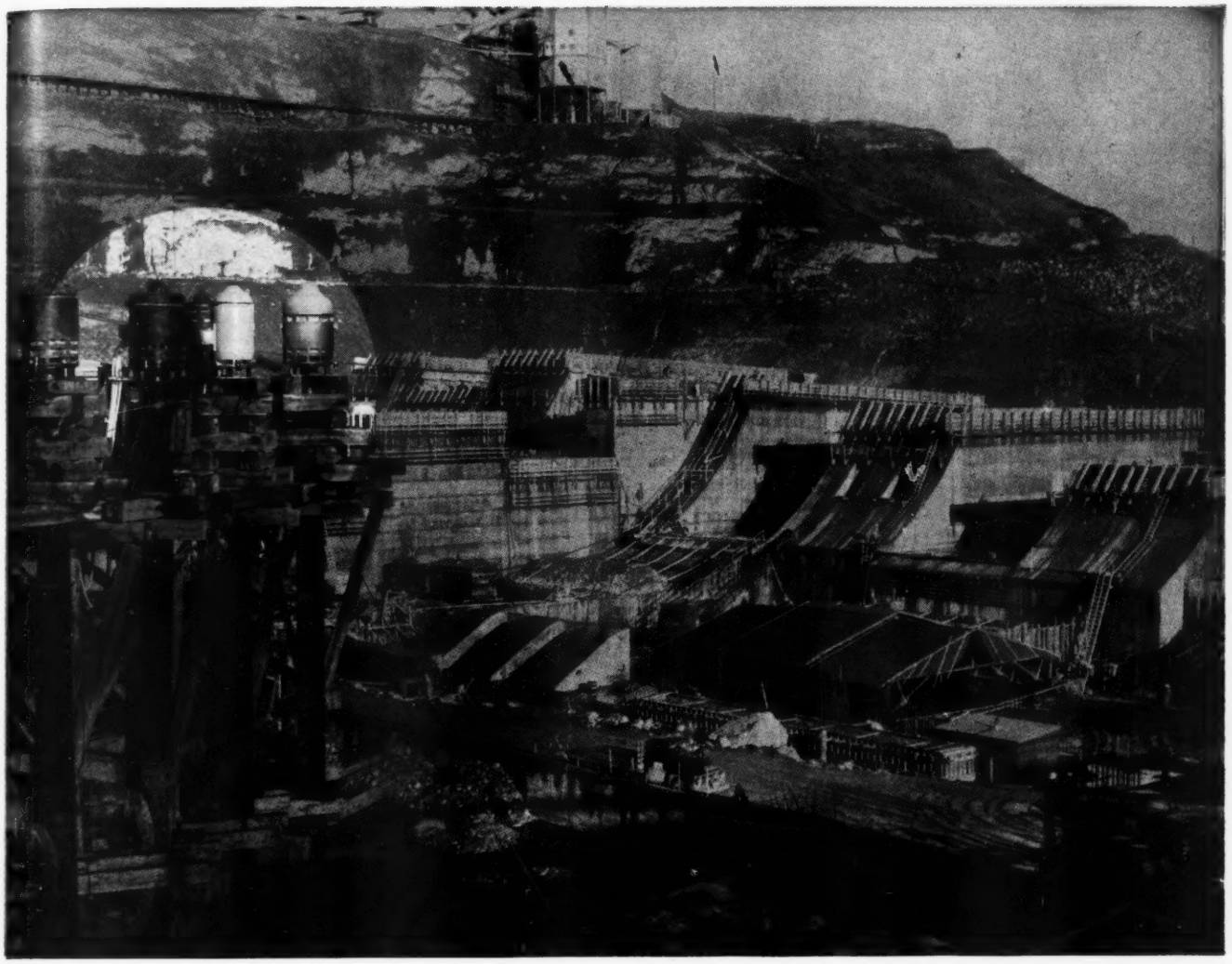
DOWNBEAT—Business enterprise will spend a little less for new plant and equipment this year than was estimated last March. The latest survey by the Commerce Department and SEC indicates that $26.7 billion will be expended this year, 6% less than the record $28.4 billion invested last year in new plant and equipment.

ONLY $7,113 in 1946—Plant and equipment account for 50.5% of the total investment of $12,605 per worker in manufacturing industries in the postwar period. A recent revision of "Investment for Jobs", a study by the Chamber of Commerce of the United States, shows that of the remainder of the total per-worker investment, 23.4% was for inventory, 22.8% for working capital, and 3.3% for land, financing and other costs.

HUMAN FAILURES—Determining that almost 90% of the 8,862 commercial failures in 1953 was due to lack of managerial ability and business experience, Dun & Bradstreet concludes that "Business failures are human failures." In their study, "First Five Years Are the Hardest," it was disclosed that about 59% of the firms that failed last year were only five or less years old.

CONSTRUCTIVE TRAVEL—It may be difficult to believe at first, but almost as much will be spent for travel this year as will be spent for total new construction. There's a direct tie-in, of course—the $25-26 billion estimated to be expended on travel this year was the reason for the boom-levels of construction of motels and other travel and vacation facilities.

THIS AND THAT—Quote of the Month: "We are going to get (next year) the guaranteed annual wage. There is no question about that." Walter P. Reuther, president of United Automobile Workers of America . . . . . An "Inventory of Available Industrial Plants in the Counties of Maryland" is published quarterly by the Maryland State Planning Commission. The latest issue shows that 238 units, from 5,000 sq. ft. to over 100,000 sq. ft., are available in the Baltimore Metropolitan Area . . . . With the advance of the stock market to heights reached formerly only in the Fabulous Twenties, the short position on the New York Stock Exchange also reached a total at the end of summer that was the largest since early 1932. Holders of such positions anticipate repurchase at lower price levels . . . . The average cost of the two 45,000 ton supertankers to be built in Japan for an American firm will be less than half the cost in an American yard . . . . Recommended reading: "America's Economic Horizons," a 32-page economic survey by Marcus Nadler, The Hanover Bank, New York City . . . . Mr. F. M. Folson, pres. of RCA, predicts sales by the electronics industry will approach $12 billion annually by 1957. Rising from $1.6 billion in 1946, such sales totaled $8.4 billion last year.



Joseph, Chief of the Nez Perce, was a mighty tough Indian . . .

and his namesake, big Chief Joseph Dam has also given the palefaces plenty of headaches. The engineers building it have waged a continuous battle against the Columbia River . . . its tremendous seasonal flows . . . its solid rock bottom . . . the pervious nature of its banks. The dewatering problem, too, is king sized. Rain and seepage could be costly . . . even dangerous.

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ATOMS IN ACTION

THE MAJOR technical problems yet to be solved in the development of successful power reactors concern the fuel elements themselves and safety. Lawrence Hafstad, director of the AEC's Division of Reactor Development points out that no fuel elements have been devised that are easy to fabricate and reprocess, that will permit high burn-up, and that also will be cheap. The only answer so far has been the homogenous reactor—using a soup of fuel and moderator. But the problems of corrosion in the homogenous reactor have proved too troublesome so far. Insurance costs and public liability are items yet to be fully settled as a consequence of safety considerations.

A FIGURE has been put on those oft-referred-to effects of atomic power on the world's areas of declining economic activity and on areas hitherto cut off from full economic development by lack of fuel and water. On a world-wide basis, it is predicted that the electricity-from-the-atom age will some day find utilization of electric power at 20 times present levels; this 20-fold increase is predicted to arrive within the next 50 years. The engineer's work appears to be cut out for him.

A REACTOR A YEAR for utility power is in the thinking of many at the AEC; suggested routing for the entry of utilities into the atomic power arena is crystallizing along these lines: for their own education and for the national good, utilities should seriously consider substituting a few nuclear power plants for conventional plants in the course of normal expansion. The justification for the substitution is formulated on the following: (a) the nuclear plant can be expected to cost significantly more than a conventional plant if only for the "ignorance factor" involved; (b) though the higher cost of the nuclear plant cannot be justified in the normal costs of utility operation, routine expenditure for expansion by addition of conventional plants would not be questioned; and (c) the theory of operations motivating the AEC, on the other hand, are not compatible with long-range operations of plants (as is the tradition of the utility business), but research and development costs are the accepted routine in the AEC. Based on these assumptions, the AEC staffers envision a joint program of cooperation with utilities wherein the utilities would underwrite the cost of a nuclear station to the extent of the value represented by an equivalent conventional plant, and the AEC would finance the additional costs of the nuclear station as a part of its research and development program.

THE FIRST REACTOR directed toward industrial research has been tentatively approved for the Armour Research Foundation. ARF will foot one-third of the $500,000 cost, and industry is being invited to speak up for the balance by taking subscriptions tagged at $20,000 each. The reactor will be free of all restrictions not called for by technical common sense. ▲▲

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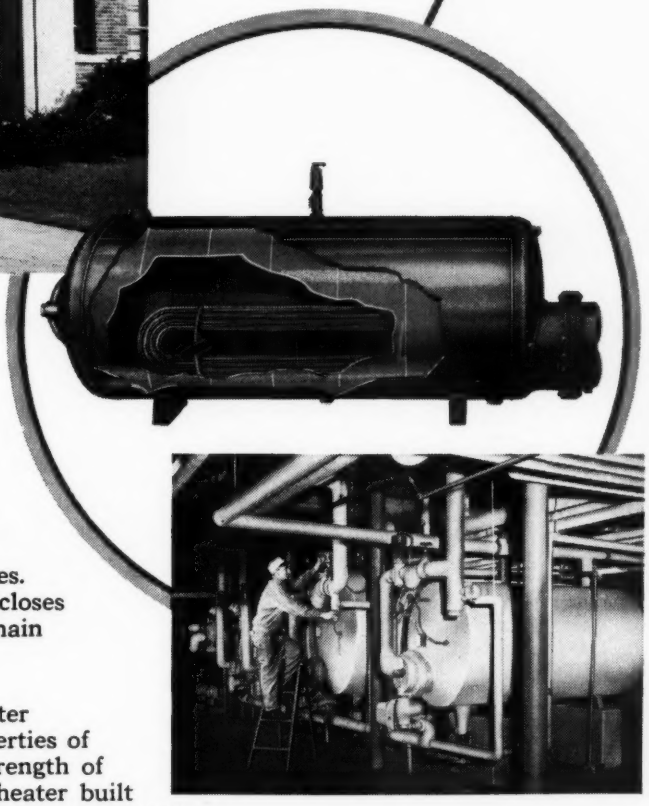

Pure, rust-free hot water is a *must* for dairy operations. For that reason, the men responsible for specifying hot water heaters for Supplee-Wills-Jones Milk Company in Philadelphia decided many years ago on **p-k** copper-lined hot water storage heaters as the best bet against corrosiveness in water.

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DR. GERALD J. MATCHETT
Department of Business and Economics
Director, National Center of Dynamic Equipment Policy
Illinois Institute of Technology

. . . guaranteed annual wage

PEOPLE familiar with trends in labor-management relations have been conscious for some time of the increasing interest on labor's part in the guaranteed annual wage. The subject came up during the course of the recent steel negotiations (though it was soon dropped as an issue in actual bargaining). It seems likely—judging by the expressions of some of labor's leaders—to assume importance in automobile industry negotiations in the coming year. (See "Economic News Notes," p. 14)

Guaranteed steady employment is as important to working men as is the level of wages. As a matter of fact, the earliest pages of organized labor's history show evidence of the significance that has been attached to this issue. It stems from the fear of unemployment that also lies behind resistance to technological development in some unions. It is at least one factor involved in union demands for closed shop or preferential hiring arrangements. It is often an element that enters into jurisdictional disputes between unions over work assignments.

Seniority plans—common features in modern collective bargaining agreements—are designed to ensure, among other things, that long term employees of a firm shall have a measure of security against layoffs. This is consistent with the often-expressed belief of labor that an employee should be thought of as accumulating, over the years, a "right to the job" that should be secure when work is scarce.

Promoting Jobs

But preferential hiring plans and seniority arrangements are primarily devices for allocating available jobs among workers. There are other union proposals directed toward promoting the availability of jobs. It is in this category of union objectives that the guaranteed annual wage falls.

Guaranteed annual wage plans are not currently common. Probably not over 300 are in effect today. However, their importance as a potential bargaining issue is greater than this figure would suggest.

A guaranteed annual wage plan commonly stipulates a minimum number of weeks of employment for employees coming under it. In most present agreements, less than a full year's work is guaranteed. A degree of flexibility for the employer is embodied in the characteristic arrangement that not all employees receive the guarantee. A worker generally must have been employed by the firm for a minimum of about two years in order for the plan to cover him; this restriction is clearly necessary if the employer is to have any latitude in hiring temporary labor to meet peak production requirements. Its existence, however, creates problems that are equally clear.

In a number of agreements, covered workers are required to work overtime during rush periods without supplementary overtime pay. The Fair Labor Standards Act (the Wage and Hour Law), which regulates overtime pay in industries where the product enters interstate commerce, has special provisions relaxing the requirements on overtime compensation where guaranteed annual wage plans have been instituted under collective bargaining.

Labor Becomes Fixed Cost

From the standpoint of the employer, a guaranteed annual wage has the effect of transforming a sizable portion of the wage bill from a variable to a fixed cost. Much of his labor cost, in other words, can be computed in advance just as rent, depreciation charges, interest, and property taxes. The greater the fixed costs that management has to meet, the less is the possibility of making adjustments to changing conditions.

If an employer is required to guarantee wages, he is furnished with a strong incentive indeed to stabilize employment. It is interesting in this connection to note the similarities in intent between guaranteed annual wage plans and a far commoner feature of collective bargaining contracts—the provision for dismissal wages, or severance pay. Dismis-

sal wages are ostensibly a way of "tiding over" employees who have been laid off. They are also a penalty—so to speak—that the employer is required to pay if layoffs become necessary. Hence, union leaders have seen in severance pay a means of putting pressure on employers to stabilize employment. In some ways, then, the guaranteed annual wage might be regarded as an extension of the idea of the dismissal wage.

Unemployment

In order to realistically evaluate the significance of any measure intended to promote regular employment, it is necessary to get into the whole problem of unemployment. For an individual, unemployment is a simple enough condition to define. For purposes of economic analysis, on the other hand, we have to recognize that employment may decline in a given business or industry for any one of several reasons. It is customary to group these reasons into two classes—non-cyclical and cyclical reasons.

Non-cyclical unemployment is the result, basically, of the dynamic character of the economy. New firms enter the scene, and old ones disappear—even in times of general prosperity. New products and new production methods are continually being developed, stimulating changes in consumer buying habits as well as in manufacturing methods. Seasonal fluctuations in employment, too, form a considerable element in the total picture. Cyclical unemployment, in contrast, is depression unemployment — occurring in connection with swings in the nation's business cycle.

Management's Burden

How much can management be expected to do about stabilizing employment? The answer to this question casts much light on the implications of the guaranteed annual wage. In the matter of seasonal unemployment some firms have had considerable success in

smoothing out seasonal peaks in their operations. Devices that have been used to this end include careful and efficient scheduling of operations, product diversification, plus efforts to set up marketing arrangements and to alter consumer purchasing habits. Whether instituted under the pressure of union demands or not, such measures are usually good business from management's standpoint.

Technological Displacement

The displacement of workers by improved machines and production techniques is often profitable to management, and in the long run is the key to improved standards of living for the nation as a whole. Nevertheless, considering the personal hardships it imposes on the displaced workers, one can well understand labor's desire to safeguard employees from the hazards and disruptions that accompany industrial progress. A device—such as the guaranteed wage—that makes layoffs more costly to management may serve as a means of inducing management to institute technological changes less rapidly, and it may also encourage retraining programs and other measures to eliminate the necessity of dismissing long-term employees.

It is difficult, though, to see how any union measure can cause individual employers to take effective steps against cyclical unemployment. The causes of the business cycle are obscure and are subjects of much controversy; but virtually all economists agree that forces far beyond the control of the individual business man are behind this phenomenon. It is interesting that practically all the guaranteed annual wage plans now in operation are in firms producing consumer goods where demand is relatively stable. The three best-known plans are those at the George A. Hormel Company, the Nunn-Bush Shoe Company, and the Procter and Gamble Company; the demand for meat, shoes, and soap tends to be stable. In the heavy goods industries, where cyclical trends are felt with greatest severity, guaranteed annual wages have gained no significant footing.

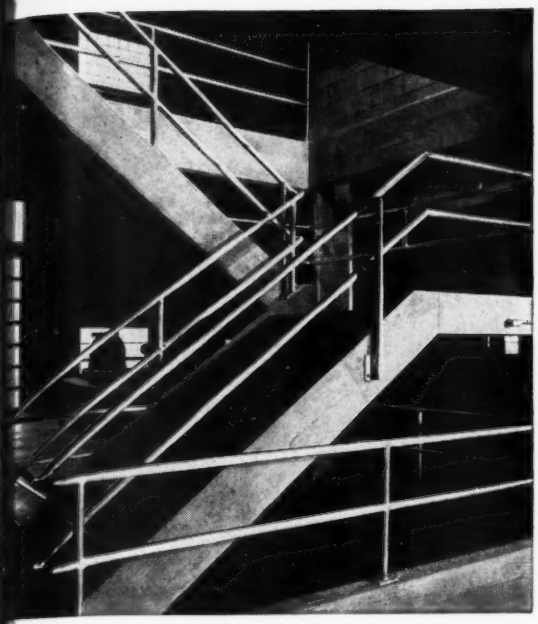
No Universal Acceptance

Though the guaranteed annual wage is becoming increasingly important in labor-management relations, not all union leaders are equally enamored of the idea. Some labor spokesmen believe that the guaranteed annual wage is not worth any significant sacrifice in hourly rates, fringe benefits, or similar matters. Moreover, any feasible guaranteed annual wage plan contains a potentially unfavorable element in the requirement that employees are covered only after some two years of service. Some unions believe that employers might seek to reduce the effects of the plan by permitting only a relatively small number of workers to attain this service period. Thus the plan would discriminate in favor of a group of long-term employees at the expense of a sizable force of workers in temporary status. The critics see the guaranteed annual wage as amounting to little more than a glorified seniority system at best. Thus, the future of the guaranteed annual wage is far from clear.

Ce quotes --

I believe, very strongly and deeply, that every professional man owes a special obligation, by virtue of the public trust, confidence, and respect that are reposed in him. It is not sufficient for him to give routine compliance or a minimum of service. . . . Our professional lives must be imbued with a high guiding purpose and a deep inner conviction that our work will endure; that our influence will live on; that we are building not only for our own time but for generations that come after us!

David Barnard Steinman
Consulting Engineer



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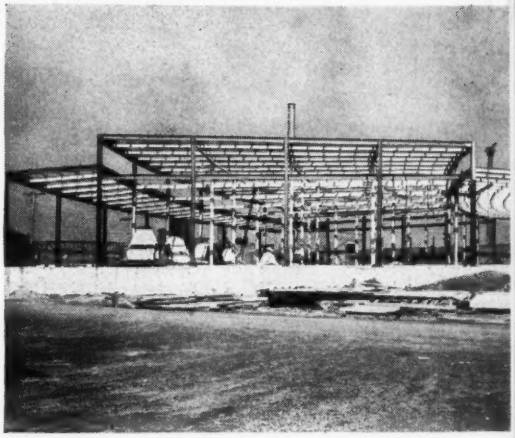

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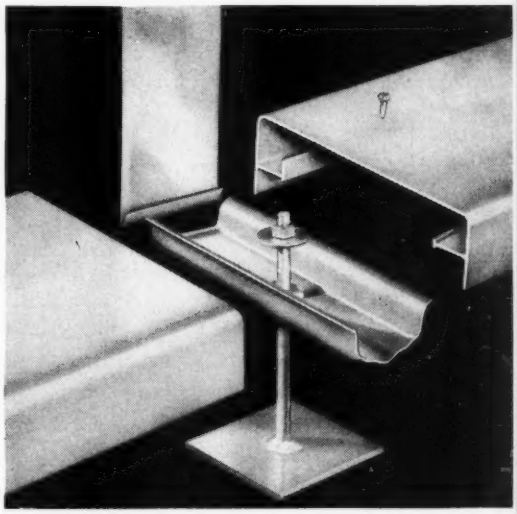

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ALCOA ALUMINUM

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the Legal Aspect

MELVIN NORD

Consultant in Legal and Technical Problems

Registered Professional Engineer

Patent Attorney

. . . who invented it first?

CONSULTING ENGINEERS are frequently involved in one way or another with patents — either in obtaining them, in giving expert testimony relating to them, or in exploiting them. It is important for them to have a working knowledge of the basic facts and law relating to patents in order to avoid falling into some of the pitfalls in this field.

In order to obtain a patent, one obviously must be the inventor—or the first inventor, as the law puts it. Some people assume that because they have filed a patent application first, they are necessarily the first inventor. Other people think that because they "thought of the idea first," that they are the first inventor. Neither position is quite right, although the date filing and the date of conception are important.

Real Test

The real test determining which of several "inventors" is the "first inventor" depends on determining the "date of invention" of each. Unfortunately, the law on this point is relatively obscure (that is to say, even more obscure than other law). This is what the statute has to say about the subject: "In determining priority of invention, there shall be considered not only the respective dates of conception, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other." This tells you what factors will be considered, but not what the answer is.

The answer that has been worked out is the following: The inventor who has first "reduce his invention to practice" is presumptively the first inventor, but this presumption can be rebutted by another inventor who can prove (a) that he was the first to conceive the idea and (b) that he has been diligently working on the invention without interruption from a time preceding the date of conception by any other inventor.

Thus, earliest "reduction to practice" is prima facie proof of priority. There are two alternative ways by which an invention can be "reduced to practice." The first is "actual" reduction to practice which is established by constructing the device and using it (or carrying out the process). The second is "constructive" reduction to practice which is achieved by filing a patent application. Obviously, there can be no question as to the date of filing an application; disputes as to the date of reduction to practice thus revolve around attempts to prove "actual" reduction to practice prior to filing the patent application.

Disputes as to priority of invention arise infrequently considering the number of applications made for patents, but such disputes are by no means rare. When they do occur it is likely that the invention is one that is really practical and valuable, otherwise, it is unlikely that more than one person would work on the idea at a given time.

Take as an example a recent case decided by the U.S. Court of Customs and Patent Appeals. The case was that of *Peter L. de Benneville v. Arthur William Anderson, 212 Fed. (2d) 612, decided* April 9, 1954.

Alpha-Aminoisobutyronitrile

Both de Benneville and Anderson invented, independently of each other, a new method of producing a certain chemical useful as a polymerization catalyst. The compound was known before, but was available only through the use of an expensive reactant. The method involves reacting alpha-aminoisobutyronitrile with a hypochlorite in an aqueous solution at a temperature of about 0 C.

Each of the inventors discovered the same method of producing the chemical at a reduced cost. Each filed a patent application, neither one knowing that another inventor had also discovered the same method. Anderson filed his application on April 5, 1949; de Benneville filed 3-½ months later, on July 22, 1949. Each patent application contained claims that were very similar to the other. Each of the applications was sent by the Patent Office to the same

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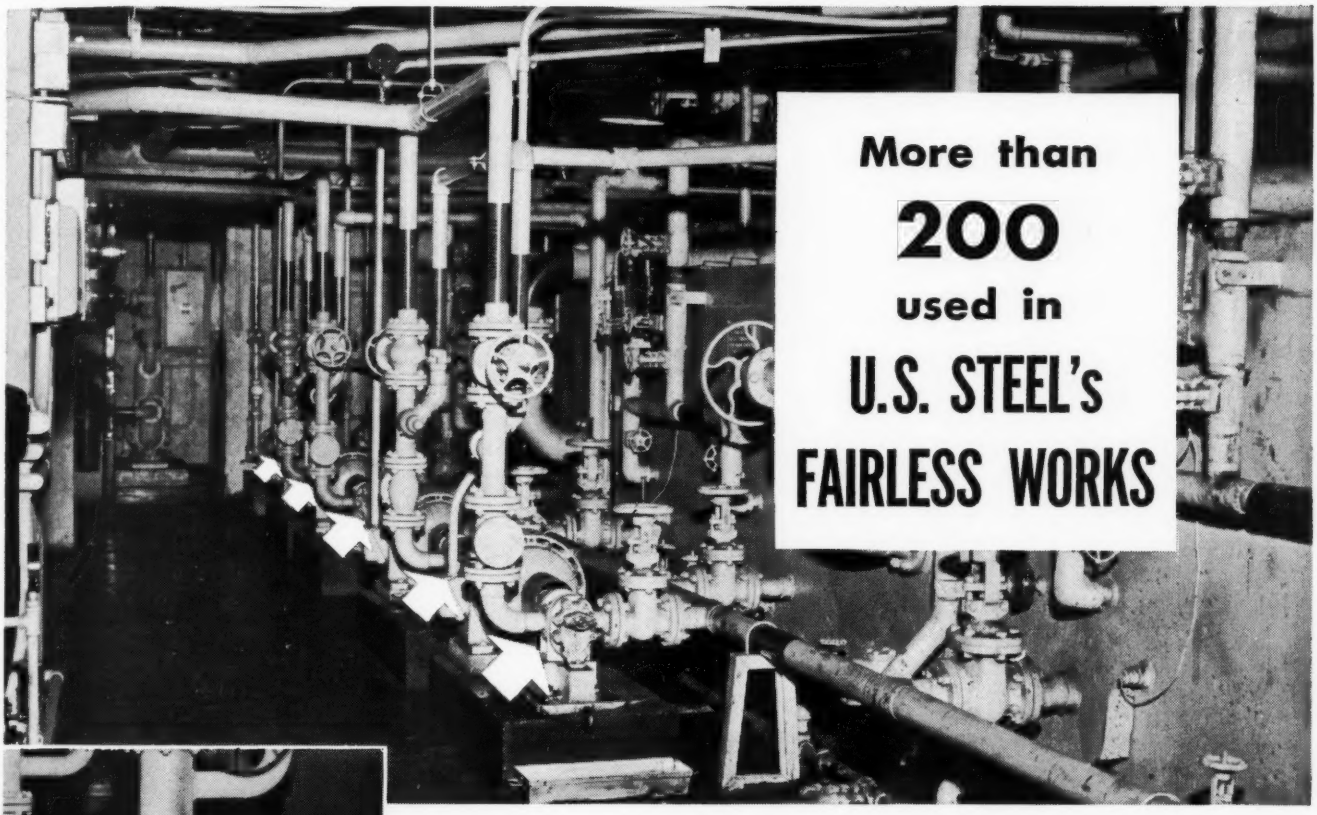
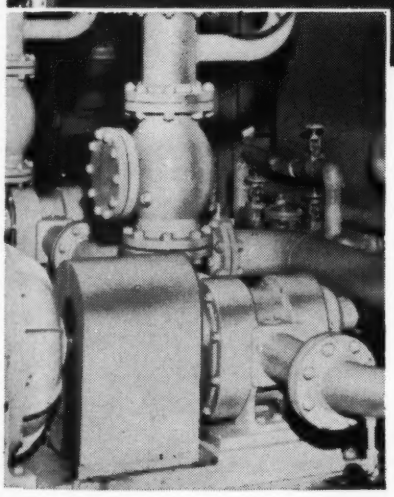


Typical installation in the oil cellar of the Fairless Works Blooming Mill shows a Lube Oil System built by Bowser, Inc., which employs five Sier-Bath Internal Gear & Bearing "Gearex" Pumps.



Two Other *Sier-Bath* "Gearex" Pumps in Lube Service at the Fairless Works

Capacities of Sier-Bath "Gearex" Pumps range from 1 to 550 gpm. Discharge pressure is 250 psi for viscous liquids, 50 psi for water or light oils. "Gearex" Pumps are available in internal or external gear and bearing types for lubricating or non-lubricating liquids, and in horizontal or vertical construction. Steam jacketed bodies and other special adaptations can be supplied.

"LIFE BLOOD" for bearings and gears in steel mill equipment is *lube oil.* Multiple "hearts" of the lube oil systems are the pumps, which ceaselessly feed the equipment from the great oil cellars below. Pump failure can mean loss of production time for pump maintenance or replacement—cause bearing or gear failure, with product losses in the thousands of dollars.

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Other advantages for continuous operation are pulseless flow (in lube service oil pressure stays constant at bearings, gears) . . . no vibration . . . cool operation . . . low noise level . . . easy installation and maintenance. For complete information, send for Bulletin G-2. *Sier-Bath Gear & Pump Co., Inc., 9257 Hudson Blvd., North Bergen, N. J.*

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patent examiner as they were received. They were examined in their turn, and the examiner found allowable claims by de Benneville and by Anderson.

However, before either patent was issued, it was compared with all the others of a similar type in the hands of the examiner. When he noticed the substantial identity of claims between Anderson and de Benneville he declared an "interference" between the two applications. In order to eliminate differences in language between the claims of Anderson and de Benneville, the examiner proposed that each adopt a claim that he suggested as being identical in principle with those of both Anderson and de Benneville. After some modification of this proposal by de Benneville, who insisted on the use of the broad term "hypochlorite" instead of the narrower term "sodium hypochlorite," each adopted the following claim, which was to be the basis of the test for priority:

"Process of preparing alpha, alpha-azodiisobutyronitrile which comprises reacting alpha-aminoisobutyronitrile in an aqueous solution with a hypochlorite selected from the group consisting of alkali metal and alkaline earth metal hypochlorites at a temperature of about 0 C."

Since Anderson had filed first, he had the earliest constructive reduction to practice, and therefore presumptively had priority of invention. The burden of proof was on de Benneville to show that he had made his invention before April 5, 1949; otherwise his patent application would be denied.

The first evidence submitted by de Benneville was an experiment performed Nov. 29, 1948 and recorded on p. 48 of his notebook No. 7. The notebook was signed and witnessed on p. 54 for pages 45-54, inclusive, on December 10, 1948. This record was held not to establish reduction to practice for two reasons. First, no mention was made by de Benneville in these notes of the temperature of the reaction; secondly, there was no corroboratory evidence by someone to whom the invention had been disclosed and who understood the invention.

Equilibrium Not Clear

Witnessing de Benneville's signature was corroboration of nothing but his signature, and not of the details of the process as described in the notebook. The court said that although there was a notation of the use of an ice bath, this did not establish that the temperature of the reaction was about 0 C because "It is not clear that a state of equilibrium was reached between the ice bath and the materials used in the experiment. Further, the reaction of these materials is an exothermic reaction, which indicates that the temperature of the solution increases as the materials react." Therefore, de Benneville's Nov. 29, 1948 date was not allowed.

de Benneville next introduced evidence of a second experiment performed on Dec. 16, 1948. This experiment was carried out by Mrs. Jane H. Macartney on behalf of and under the direction of de Benneville. Thus, corroboratory evidence by a person to whom the invention had been disclosed and who understood it was available. The question remaining was whether the process claimed had actually been carried out in the laboratory at that time. This experiment was also conducted in a cooling bath of ice. The note in the notebook read in part as follows: "Dropped in the amine (aminonitrile) keeping the temperature at 5 to 10 C. Addition took 15 min. Some exotherm noticed. Stirred for 2 hrs at 0 to 5 C."

No Reduction

The court held that this was not an actual reduction to practice, because the process had not been carried out "at about 0 C," as stated in the claim! The court

said that "There is nothing to indicate that the reaction continued during this two-hour period" when the temperature was kept at 0 to 5 C, that apparently the exothermic reaction ceased when the temperature reached 10 C, after which it was easy for the ice bath to cool the reaction products down to 0 to 5 C.

Discrepancy of Degree

The court held that the experiment was done not at "about 0 C," but at 5 to 10 C, that the language of the agreed-upon claim in the interference proceedings ("at about 0 C") did not include 5 to 10 C. Therefore it was held there was no actual reduction to practice at that time. As a result, de Benneville lost out altogether, and Anderson was declared the "first inventor."

This decision is interesting because of the grasp of technical details of the invention exhibited by the Court (a rare situation in courts other than the U.S. Court of Customs and Patent Appeals). It seems quite logical for the court to conclude that the reaction mixture was at 5 to 10 C instead of at 0 C during the progress of the reaction.

Technical Decision

The decision seems to be much too "technical." However, Anderson's patent will probably be of no value to him. All anyone will need to do is carry the process out in an ice bath without taking extra precautions to keep the reaction mixture below 10 C during the addition of the amine. If the Court is correct in its holding, such an action would not infringe! And if that is so, it seems that neither party will have the protection of a patent.

All we need to hear now is that de Benneville is being enjoined by Anderson from carrying out the process in an ice bath at 5 to 10 C because that is "about 0 C." It all goes to show that someone is trying to make patent law tough. And they are succeeding! ▲▲

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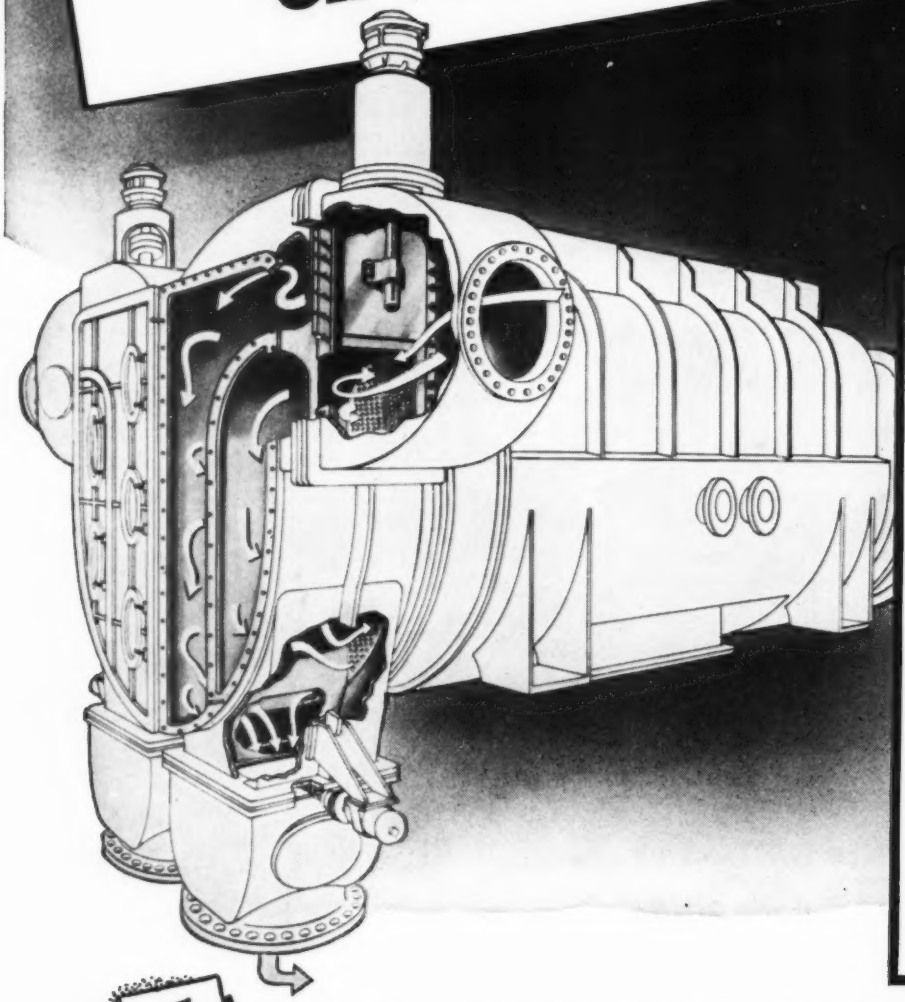

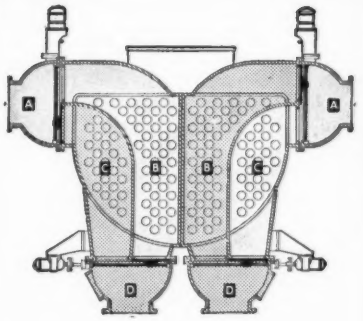

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Left side: flow is reversed. Valves at inlet "A" and discharge "D" are changed to permit water to flow through "B" and back through "C" in the opposite direction and then out through the left port of "D."

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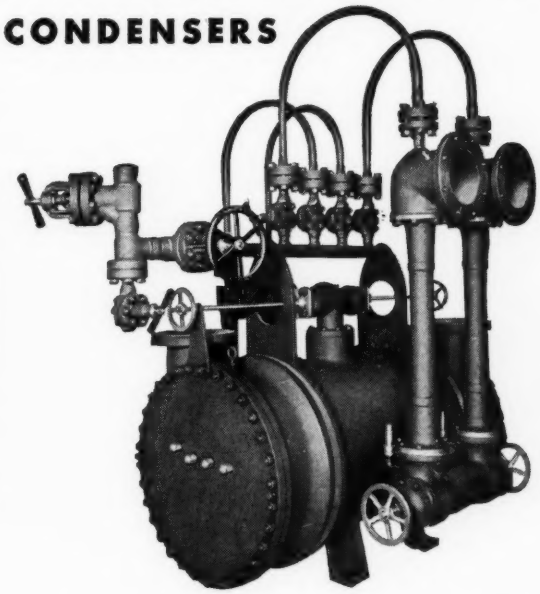

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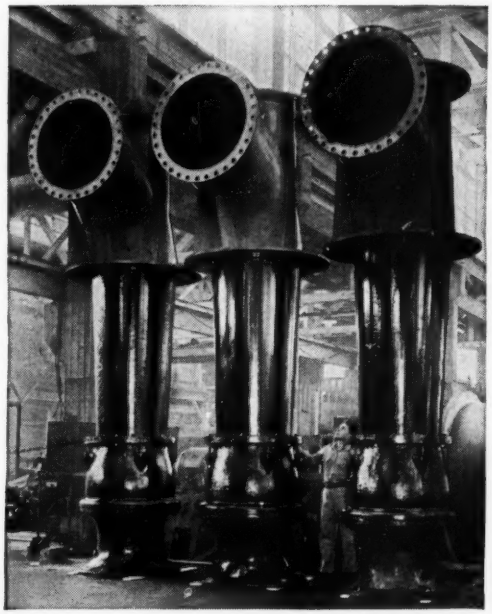

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Engineers Associated

Many cases in courts of law require the experience and abilities of engineers for the clarification of the issue involved. Many times, it is consulting engineers who are retained by the plaintiff or defendant. This article takes up their problem as the case begins.

IN MOST COURT cases involving technical testimony, and certainly in the major ones, engineer-expert witnesses for both sides are requested by their attorneys to attend court during the examination of lay witnesses. Thus, they hear the testimony and follow the disclosure of evidence—especially as it bears up under cross examination.

In listening to the cross examination of lay witnesses, the expert has the invaluable opportunity of observing the manner, technique, and diplomacy of the opposing counsel in cross-examining witnesses. The discerning expert witness can observe the course of his questioning, his apparent grasp of the subject matter at issue, the depth of his thinking, the pertinency of his questions, and the generalship of his tactical maneuvering.

After being called to the witness stand, sworn in, and giving his name and address to the clerk of the court, the expert is asked a series of questions by

his counsel to reveal those qualifications making him an expert witness. Professional history, length of time in practice, and experience are stated. Starting with formal education, the expert generally is given a free rein to continue his citation of professional background. Specific questions can be asked relating to degrees and honorary awards, research studies and publications, professional experience (especially as it relates to the court case at hand), membership in technical and scientific societies, and professional engineer licenses. Before concluding, a brief statement may be given describing the expert's professional specialization in which he may be a recognized authority.

Frequently, opposing counsel interrupts recitals of the witness' qualifications by stating that he is perfectly willing to concede them. The strategy in such a move is to prevent the jury from hearing qualifications that might build up the stature of the witness, Therefore, a concession of the qualifications of an expert witness should be emphatically declined. Instead, his full qualifications should be developed for the court and jury to hear.

Quote Experience

If the expert witness has publications within the general field pertinent to the court case, reading their titles into the court record can prove significant and important. Sometimes the attorney likes to have his expert cite a few major court cases on which he has served, especially if some of them have been tried in cities scattered over an impressively large geographical area.

In brief, the attorney wants his expert to present an impressive record of educational attainments, professional experience, and notable achievements in a pleasing, convincing, and reassuring way. The expert should be clear, straightforward, modest, and reasonably complete. From the time the expert witness responds to the court clerk's call to the witness stand until he is dismissed the jurors subconsciously register, appraise, and weigh every move, facial expression, manner of speech, and physical idiosyncrasies (eye response, directness of address).

Establish Professional Dignity

Should presentation of qualifications be given in a pompous, vainglorious, and conceited manner — as occasionally happens—the appraisal of the expert by the court and jury will be anything but flattering; indeed, it might even be antagonistic. Even before he has completed his qualifications, many an expert has lost the dignity of a professional man, the respect of the court and jury, and the value of whatever contribution he had hoped to make for his associates.

Nothing is so deadening in court as to listen to an expert witness who starts reciting his career at babyhood, and then gives (blow-by-blow) the minutiae of his educational and professional career over a 65-year life span. One such expert, in stating his qualifications, said with affected pride that the Professional Engineers' Licensing Board had conferred high honor on him by granting him a low state license number. This was a flagrantly dishonest statement as the Board issues the licenses in order of their application and approval; furthermore, being a professor, the license was issued to him under the "grandfather clause" without written examination.

The Hypothetical Question

Soon after the expert witness qualifies, his attorney will likely ask him a hypothetical question. This gives the expert an opportunity to explain the chain of events which, in his opinion, led up to and caused the catastrophe basic to the litigation.

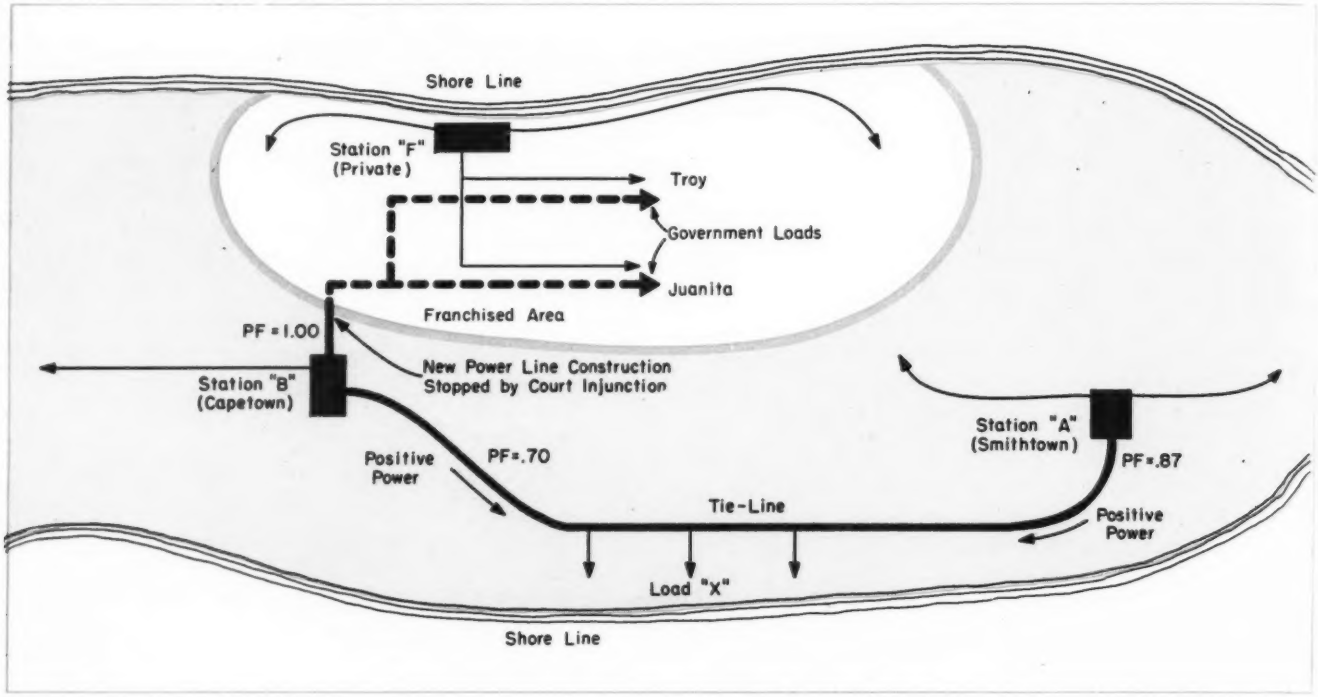
The hypothetical question presents a series of assumptions, each of which is carefully predicated directly on evidence given by the lay witnesses. Generally, the expert witness works with his attorneys in framing the terms of the hypothetical question. The hypothetical question may be short and simple, or it may be quite long in an involved litigation, including in it the assumptions of fact based on the lay testimony.

The framework within which all hypothetical questions are phrased is more or less standard. It assumes each necessary salient fact, one after the other, from the submitted evidence. After reading all of the essential assumptive clauses, the hypothetical question is closed by asking the expert witness in suitable phraseology, "Do you have an opinion as to how the accident occurred?" The expert witness always answers with a strong, clear, positive "Yes."

The Expert's Theory

Then the expert is asked what his opinion is. After stating his opinion in a few words, he is asked to explain this opinion and interpret it in nontechnical language, if possible, for the benefit of the court and jury. This answer calls for an explanation of the expert's theory, which he has evolved from his study of the factual information relating to the cause of the occurrence and the sequence of subsequent events.

The expert witness may be able to explain his theory in a simple technical case in a few minutes or in an hour or so. In some types of highly technical litigation, an expert witness may need days to explain his theory in sufficient and satisfactory detail to make all the elements in the case clear and convincing. In a long discourse of this nature, both the attorney and the expert must be increasingly watchful of the interest shown by the court and jury as time passes. Unless the expert can



ORIGINAL FRANCHISE PREVENTED GOVERNMENT FROM DISTRIBUTING POWER IN PRIVATE UTILITY'S FRANCHISED AREA. ENGINEER-EXPERT SHOWED THAT GOVERNMENT'S STATION "A" COULD FEED THROUGH NEW LINE TO THE AREA.

sustain continuous interest by means of illustrations, demonstrations, and experimental techniques as well as by his method of address, he would do better to curtail his answer at the sacrifice of completeness. The attorney later may ask specific questions to emphasize and clarify those elements of the expert's theory that were perhaps omitted completely or considered too briefly.

The expert may use illustrations during his explanation to clarify physical or scientific elements. Photographs are extremely helpful and significantly important, if available, when they show critical situations during or after the accident. Illustrations also may be drawings or sketches made and explained by the expert with telling impressiveness. Models especially prepared for the occasion or simple experiments may be utilized effectively to great advantage because of their interest appeal in conveying a clear understanding and visualization of conditions before, during, or after the catastrophe being investigated.

Show Confidence

During his answer to the hypothetical question, the expert should show confidence, poise, integrity, and sincerity in his manner of presentation. He should address his statements directly to the jurors; he should watch every one of them and be guided by their facial expressions, which will indicate whether he is making his explanations clear.

Using commonplace examples to illustrate complex situations is an excellent way of clarifying difficult and technical elements. Striking, easily remembered, straightforward, and forceful statements will favorably impress the jurors. When they retire to the jury room to review and discuss among themselves the merits of the testimony and evidence, such favorable impressions subconsciously made by the expert witness in their minds will lend significant weight to his side of the case.

Example Question

A hypothetical question that was actually used in a highly technical and critically important litigation illustrates the general form of such questions:

Assume that a hydro-electric development, located at Smithtown, contained an installed capacity of about 6500 kva; that a transmission or tie-line electrically interrelates the operating generators of this plant with the operating generators of another hydro-electric development about 30 miles distant, at Capetown; that the approximate installed capacity at Capetown is 15,000 kva; that the average daily load on each of these plants is 3500 to 4000 kw; that each of these generating systems distributes electric power for local service over distribution lines that radiate from them into their respective territories; that a 25-mile transmission line is constructed and is in operation from the Capetown station to Troy and Juanita, supplying this urban territory a load of 1500 kw; that no transmission line connects the Smithtown station directly with the Troy and Juanita load areas. Could you say as an expert witness, with a reasonable degree of certainty on the basis of these

assumed facts, that electric power from the Smithtown system would flow over the transmission lines through the Capetown station to Troy and Juanita distribution areas?

The expert's answer was, "Yes, sir."

The next question was, "Can you give your reasons to support your answer in simple, non-technical language?"

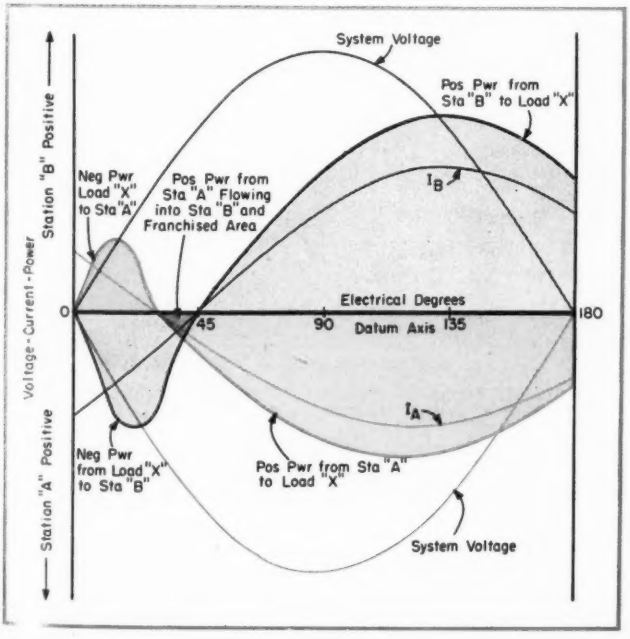
Simplified Answer

It is necessary to provide certain orientation information here before answering the hypothetical question in the case.

A large insular government, years ago, owned and operated one hydro-electric station in its Smithtown area, which is indicated as Station A in the accompanying one-line diagram. The government granted an exclusive 99-year franchise to a privately-owned utility company to supply electric power throughout the franchised area from its own electric stations located within the franchised area, one such steam station being indicated on the diagram as Station F. The franchise specified that electric power from the government Station A would not be transmitted into the franchised territory during the life of the franchise.

After the franchise ran for a few years, two unforeseen developments transpired. The first of these two developments was the construction of government buildings, a university, and hospitals within the general franchised urban area of Troy.

The government also developed some extensive granite quarries that utilized a sizable load of synchronous motors.



THE DARK TRIANGLE DEMONSTRATED TO THE COURT THAT POWER FLOWED IN VIOLATION OF FRANCHISE.

The second of the two developments was an undreamed-of expansion in the use of the bountiful waterpower resources. Additional government plants were constructed near Station A at Smithtown; a series of new and larger hydro-electric plants were built at Capetown, indicated on the diagram as Station B. A transmission line interconnecting the power plants of Station A with those of Station B supplied the needs of the intermediate loads, which are simply indicated as Load X on the power-system diagram.

Alluring Bait

The closeness of the government's new power developments at Station B to its growing loads within the franchised area in and around Troy and Juanita provided alluring bait to the electric power commission, and the government started to construct a power line into the franchised area. This power line is indicated on the diagram by the solid line extending upward from Station B. The projected construction of this transmission line, as shown by the dashed lines on the diagram, was stopped by a court injunction obtained by the private utility company, and litigation started over the franchise rights granted to the utility.

The government contended it would not be violating the terms of the franchise by using the power line it was building because it would not be transmitting electric power into the franchised area from Station A, nor could it electrically do so even if the contract did not restrain it from so doing. The government maintained that electric power would be transmitted into the franchised area only from its new Station B.

Utility Hires Expert

An expert witness was employed by the utility company in its attempt to develop some kind of a tenable theory by which to prove that electric power from Station A, nevertheless, would be transmitted over the proposed power line if it was extended into the franchised area. From an examination of annual government reports covering several years of the system operations of Station A and B, with special reference to their tie-line supplying power to the intervening Load X, it was discovered that Station A was controlled by the system load dispatcher so that it supplied its power into the tie-line at a prevailing lagging power factor of about 0.87, corresponding to a power factor angle of 30 degrees. Station B fed into the tie-line at a prevailing lagging power factor of about 0.70, corresponding to a power factor angle of 45 degrees. The difference in power factor angles proved to be the peg on which the case was hung.

On the basis of these prevailing station power factors, the expert witness showed that Station B

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CE exclusive

How Professional is Engineering?

C. W. GRIFFIN, Jr.
Edwards and Green

ENGINEERING HAS not attained general recognition as a profession, as is made painfully evident by the current controversy over competitive bidding for engineering services. The actions of several state highway departments in inviting competitive bids for engineering services have caused deep concern, not only to the American Society of Civil Engineers but to the engineering profession as a whole. In its deepest implications, the issue concerns the status of engineering in its relation to society: is it a profession on equal terms with medicine and law, is it merely a business, or is engineering some hybrid combination of the two?

The problem calls for nothing less than a reexamination of the philosophy underlying the ethical codes of the professions, with particular emphasis on the canons that hold professional men to a more restricted degree of economic freedom than that allowed ordinary businessmen. A reappraisal of this philosophy may lead to a sound basis for evaluating the ASCE canon which declares that it is ". . . unprofessional and inconsistent with dignified bearing for a member . . . to participate in competitive bidding on price basis to secure a professional engagement."

To any engineer who has discussed the question with other engineers, it becomes obvious that there is no unanimity among engineers in supporting the professional codes. Many engineers — especially those in employee status—are not convinced that engineering is a profession. Thus it is not surprising that the general public and the lay members of the state legislative bodies that pass laws failing to recognize professional status for engineers are similarly not convinced.

Webster's New International Dictionary, second edition, unabridged, significantly fails to mention engineering in defining the word "profession," although it lists the "three learned" professions of theology, medicine, and law. Professional status for engineers is not as firmly rooted in traditions extending back into antiquity as is that of the established learned professions. The evolution toward professional status for engineering is of very recent origin. Doubtless, this lack of long-standing, power-

ful, traditional sanction as a profession has contributed to the rather anemic professional spirit among engineers as a group.

Basic Contentions

Two basic arguments for removing prohibitions against competitive bidding from the Codes are supported by some engineers—openly or otherwise—as well as by outsiders. To the cynics who believe that ethical standards in professions are generally not adhered to anyhow, competitive bidding appears to be a fairer method than the approved negotiation procedure. Then there are the super-rugged individualists to whom the *laissez-faire* concept is virtually a religion. These gentlemen, animated by such slogans as "Everything has its price!" and "Survival of the Fittest!", believe that if the law of supply and demand is allowed to operate in all economic situations—unhampered by professional ethics or any other kind of restrictions —human affairs will proceed most prosperously.

Strong elements representing these two viewpoints are present in the *Engineering News-Record* editorial of Nov. 19, 1953—the boldest and most articulate expression of the case for competitive bidding. *Engineering News-Record* declares that the ASCE canon prohibiting competition among engineers on a price basis is "self-defeating" and "unworkable," and "should be removed from professional codes of ethics." It . . "invites men of high moral character to circumvent this provision of the Code if they are to stay in business." An approved procedure for submitting and receiving competitive bids to insure that price is not the sole consideration is advocated. This procedure allegedly would have the added advantage of protecting engineers from the evils of "favoritism."

Inherent Punishment

Further, *Engineering News-Record's* editorial philosophy is most clearly revealed by the train of reasoning with which it considers the following hypothetical situation: suppose an incompetent engineer bids low and is awarded a job where the sole consideration is price. There is nothing to worry about if this occurs, for *Engineering News-Record* assures us ". . . in either case the punishment is inherent—in the form of an inferior product for the buyer and of a tarnished reputation for the engineer." This statement makes it clear that *Engineering News-Record* does not consider engineering a profession with concomitant responsibility for the public welfare, but that engineering is simply a business like retailing.

It is difficult to imagine a sane individual applying this reasoning to the field of medicine. We do not abandon the individual to the fate he invites upon himself when he would bargain for medical services. We demand that the medical profession, through licensing boards and other means, guarantee to the public a minimum standard of competence on the part of its reputable members.

It should not tax anyone's imagination unduly to see that engineering services are of a nature similar to medical services. To support this proposition, first analyze the meaning of the word "profession" to determine what distinguishes a profession from a business or a trade.

The word "profession" has been battered by misuse. Of course, such aesthetic pursuits as music and art, for example, are properly termed professions, but not in the sense to be adopted here. We are concerned with the professions that are an integral part of the functioning mechanics within society, apart from aesthetic considerations. Medicine is the prototype of professions having this general characteristic. At the other extreme, W. E. Wickenden, in his classic essay of engineering as a profession, *The Second Mile*, tells about a group of barbers who decided to become known as "chirotonsors" in order to lend greater prestige to their "profession."

Monopoly of Professions

The first—and most obvious—of the attributes distinguishing any sort of profession from other vocational groups is its monopoly of a special type of knowledge and skill, the principles of which are acquired through rigorous educational process. This condition alone distinguishes a profession from a trade. However, there remains the problem of distinguishing a profession from a business, since many positions in business require intensive academic training although they lack the slightest claim to being professions within the context normally ascribed to such as the learned professions.

Our definition of a profession contains the solution to this problem by implication. The unique attribute differentiating a profession from a business is in the nature of the profession's responsibility to society. The enlightened businessman would certainly not deny that he has certain obligations to society, but these responsibilities, as a rule, do not depend upon his special training. In the final analysis, the laws by which his business is regulated originate from outside sources; in effect, he is governed in his business activity by higher authority. Neither the foodseller nor the entire aggregate of foodsellers considered as an occupational unit, is responsible for the Pure Food and Drug Acts which regulate this business. Similarly, the building contractor is not responsible for the provisions of the building codes and specifications governing the work he performs.

Encourage Business Competition

Thus, there is every reason to encourage economic competition among these businessmen, since they are controlled by higher authority charged with insuring that their products conform to the

requirements of public health and general safety.

In contrast, a profession is charged by society with the responsibility itself of insuring the public minimum standards of proficiency by its members. Regardless of the mechanics of licensing practitioners in the professions, the professions themselves are ultimately responsible. Ideally, professional men determine the standards and laws, directly or indirectly, by which they are governed in their professional lives. The engineer is governed by the provisions of the building codes in his engineering work, but the source of the building code provisions is the engineering profession.

Contract Implied

The relation between a profession and society is described by W. E. Wickenden as follows: "Professional status is . . . an implied contract to serve society, over and beyond all specific duty to client or employer, in consideration of the privileges and protection society extends to the profession." Since high standards cannot be maintained through legalistic measures alone, codes of professional ethics have evolved. These ethical codes might be conceived as the means of fulfilling the implied contract between society and a profession. In serving this function the codes have two correlated aims: to guarantee the public a high degree of technical competence and honor in the conduct of professional business, and to maintain a high standard of integrity within the profession itself.

To fulfill their responsibility for insuring the trustworthiness of their members, the professional organizations have traditionally limited the economic freedom of ethical practitioners. For obvious reasons, the American Medical Association *Principles of Medical Ethics* contains this statement: "An ethical physician will not receive remuneration from patents on or the sale of surgical instruments, appliances, and medicines, nor profit from a copyright on methods or procedures."

Restrict Freedom

Lawyers, doctors, and engineers are ethically forbidden to employ sensational (and usually obnoxious) forms of commercial advertising. Lawyers are subject to disbarment for engaging in practices that "stir up" litigation. Thus, the ethical canons prohibiting under-bidding and competition on a price basis among engineers are merely two of many ethical restrictions placed upon the economic freedom of all professional men.

All of these professionally unethical practices are considered perfectly legitimate when engaged in by businessmen. Patents on original discoveries and absurd advertising claims constitute "business as usual." The acquisitive man whose primary concern is material profit may be an acceptable businessman, but the truly professional man must be motivated by a higher standard of values. The ideal of services, pride in proficiency, and the satisfaction of creative work should rank above materialistic ambitions in the professional man.

There is another complex problem confronting those who would sanction competitive bidding among engineers—a problem worthy of the attention of the profoundest metaphysician. How can engineering services to be performed be described to insure that all the competitors intend to provide the same degree of service? The contractors engaged in competition for a particular job are (theoretically, at least) bidding on the same finished product as predetermined by the plans and specifications. Thus, there is every reason to encourage competition among contractors and to award the "lowest qualified bidder" the job; it is the engineer's responsibility to see that the contractor performs satisfactorily.

Creative Service

However, engineers competing for a professional engagement are bidding for the right to perform a service which many acknowledge is creative, and therefore is completely incapable of adequate description on a bid proposal form. Last year, engineers responding to an advertisement for furnishing engineering services on a South Carolina highway bridge submitted their bids ranging from less than 3 percent to more than 7 percent of the total estimated project cost. It is inconceivable that the firms submitting these widely varying bids had planned to furnish the same caliber of creative service.

Requiring competition on a price basis among engineers is almost as absurd as requesting a group of musicians to compete for the right to compose a national symphony, under the delusion that the best dollar value in musical production will be attained that way.

Of course, the advocates of competitive bidding assure us that other more important considerations should and would enter into the selection of engineers for public projects if the practice should become established policy. However, when the mechanics of negotiating for engineering services is made identical with the mechanics of construction contracting—where price is admittedly the prime consideration—it seems rather absurd to deny that engineering services would not be selected on the same basis. Award to the "lowest qualified bidder" would definitely place the engineer on the same footing as the contractor.

Compete or Cooperate?

There are other objections to competitive bidding among engineers involving both practicality and principle. In practice, it is difficult to believe that

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DRY WALLS AND FLOORS RESULT FROM AIR CONDITIONING THE SWIMMING POOL ROOM. SIX CEILING DIFFUSERS AND TWO RETURN GRILLES UNDER THE SPECTATORS' STAND PROVIDE CIRCULATION.

CE exclusive

Comfort Air Conditioning For Indoor Swimming Pools

EUGENE B. WHITE, Engineering Consultant
Architectural & Engineering Bureau, The YMCA of Chicago

IF YOU HAVE ever been a spectator at a swimming meet in an indoor pool, you probably will recall how uncomfortably warm and humid the room atmosphere was. You may have had the feeling that only the swimmers were comfortable. Sweating walls, wet floors, and damp seats were further evidence of the humid conditions.

Because we felt such conditions had been tolerated too long, we tried a new approach to pool ventilation for the Memorial YMCA in Harvey, Illinois.* Dry floors, walls, seats, and a comfortable atmosphere, are proof of the success of this system. Similar installations are contemplated for new and old pools in Metropolitan Chicago.

Pool designers have for many years recognized the need for proper ventilation. Sweating walls, the presence of standing pools of water on floors, and the heavy humid atmosphere were tolerated because humidity conditioning was considered too expensive. Many pools do not have even mechanical ventilation, which is but a partial answer to the problem. Some have a few windows and a small exhaust fan. Such a system is little better than none.

Those pools that do have a mechanical ventilation system find them satisfactory for odor elimination and exhausting large volumes of humid air. But the room atmosphere remains saturated, and moisture remains on walls, floors, and seats. Another difficulty experienced with these systems is the noise of the large fans used. Then, too, during the winter months the entire air supply must be heated.

Besides these problems the humid atmosphere

* Burnham & Hammond, Inc. of Chicago were the architects

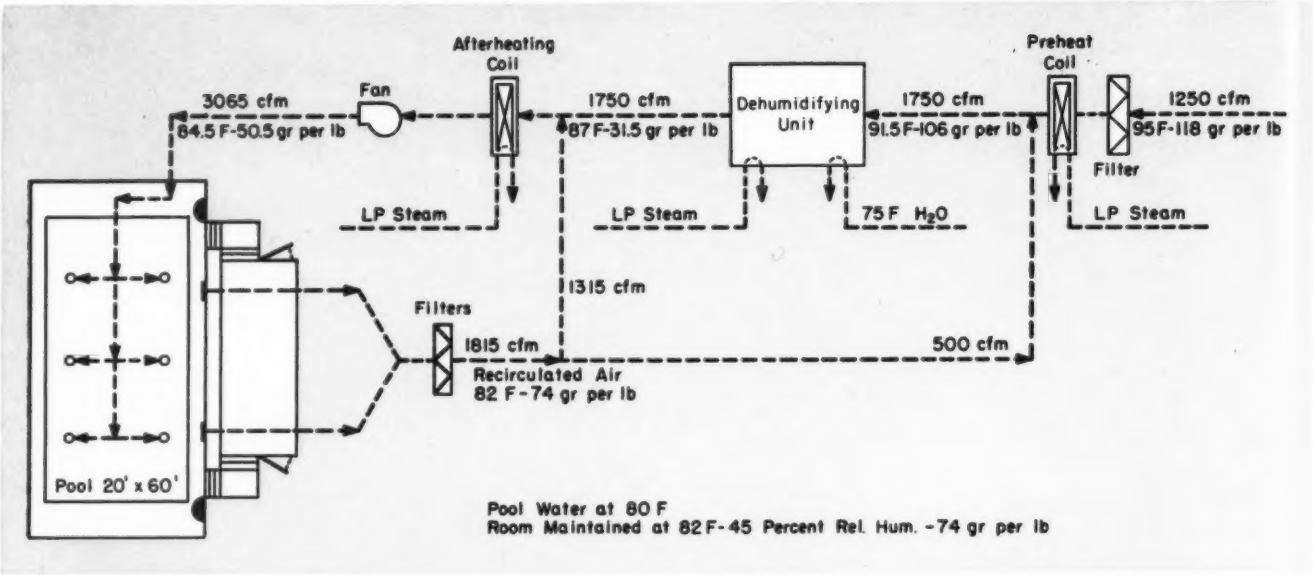


DIAGRAM OF THE AIR CONDITIONING SYSTEM AT HARVEY. AIR LEAVING DEHUMIDIFIER IS AT 31.5 GR PER LB.

increases maintenance costs. A typical example is the pitting and oxidation darkening that appears on stainless steel and aluminum doors. Steel wool must be used to restore their appearance, even for a short time. The baked on enamel on lighting fixtures develops pinholes, rusts, and then peels.

The Harvey Pool

The pool at Harvey Memorial is of dead level design, 20 feet wide by 60 feet long. Pool capacity is 60,000 gallons. The water surface is continually skimmed and fresh water supplied from a ballast tank at a rate of 10,584 gallons per hour. Turnover time is about 6 hours.

Ceramic tile has been used for the pool itself and on the walls to door height. The walls above that height are California stucco. The two pillars flanking the stairs to the spectators' platform are glazed tile. The ceiling is perforated transite over a glass fiber blanket for acoustical attenuation.

Realizing that ventilation was not sufficient, a complete air conditioning system was installed at Harvey to maintain the room at 82 F and 45 percent relative humidity. Comfort of swimmers dictated the temperature. The low relative humidity was specified to act as a sponge, drying the floors and walls while still providing a comfortable atmosphere for spectators. The air is supplied through six diffusers in the ceiling. Return air grilles are located at the base of the spectator stand.

As the schematic diagram of the pool air conditioning system shows, 1250 cfm of fresh air are introduced. Maximum design conditions for this air are 95 F and 118 grains of moisture per pound. A preheating coil is included in the system after the fresh air filters to heat outside air during winter operation. The fresh air is then mixed with 500 cfm of recirculated air.

The 1750 cfm mixture passes into a Kathabar dehumidifying unit at 91.5 F and 106 gr per lb. In this conditioning unit the moisture content of the air is reduced to 31.5 gr per lb, and the temperature is brought to 87 F. After this dehumidifying pass the 1750 cfm of air is mixed with 1315 cfm of recirculated air at about 82 F, 74 gr per lb. The mixture, 3065 cfm, is diffused into the room from the six ceiling outlets. An afterheating coil is located in the air stream to heat the mixed air if its temperature should be below 84.5 F. Low pressure steam is used.

The water in the pool is maintained at 80 F. Diffusion of the air in the room at 84.5 F and only 50.5 gr per lb makes the pool, in effect, a huge evaporative cooler. Water, evaporating from the pool, cools the room to the designed condition of 82 F. The moisture pick-up from the pool is 24.5 gr per lb, providing the desired relative humidity of 45 percent.

Dehumidifier

In the dehumidifier unit the air enters the contactor chamber on the left. There the air contacts a flood of a lithium chloride base liquid absorbent as both air and liquid flow over finned cooling coils. When in solution, this absorbent will pick up moisture from a passing air stream. The amount of moisture absorption is a function of absorbent temperature and concentration. In these units, the concentration is held constant. Solution temperature can be varied by using various coolants in the coils. The Harvey installation uses 75 F city water in the coils. Moisture reduction, as shown on the flow diagram, is from a maximum of 106 gr per lb entering to 31.5 gr per lb leaving. To accomplish

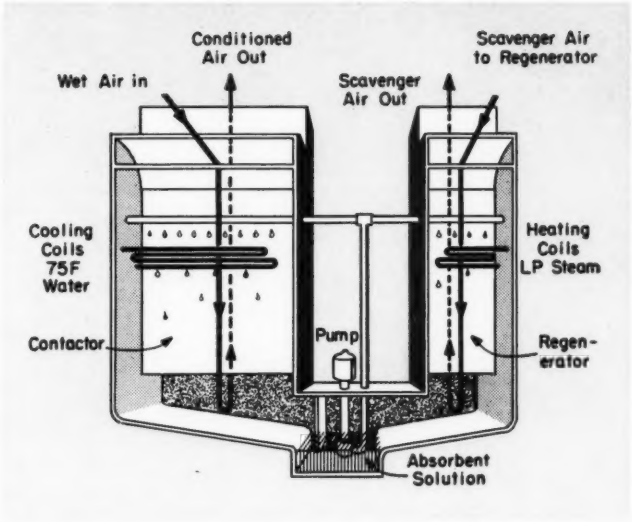
this same reduction with straight refrigeration would require cooling the air to about 37 F with a coolant suction temperature well below freezing. Besides the cyclic operation necessitated by frost formation and the expense of duplicate coils, such a system would require reheating the air.

After completing the dehumidifying pass, the dry air goes on into the distribution system, and the absorbent solution falls into a sump. A pump lifts the solution back to the contactor flooding heads.

Regeneration of the absorbent is automatic. When the solution becomes diluted, a float level actuates a valve that passes a small quantity, about 10-15 percent of the solution, to the regenerator chamber. The cycle in this chamber is quite similar to that in the contactor chamber. An air stream, much smaller than that found on the contactor side, passes through the solution as it is sprayed from the top of the chamber. At the same time, both pass over finned coils that contain low pressure steam. The temperature of the solution is raised, forcing it to give up the excess moisture in the absorbent to the air stream. The saturated air is vented to the outside, and the concentrated solution falls into the common sump to restore the concentration.

Results

The moisture reduction in the Kathabar unit, 1750 cfm from 106 gr per lb to 31.5 gr per lb, is equal to 241.2 gallons of water per day. This includes the 133.25 gallons per day pick-up from the swimming pool.

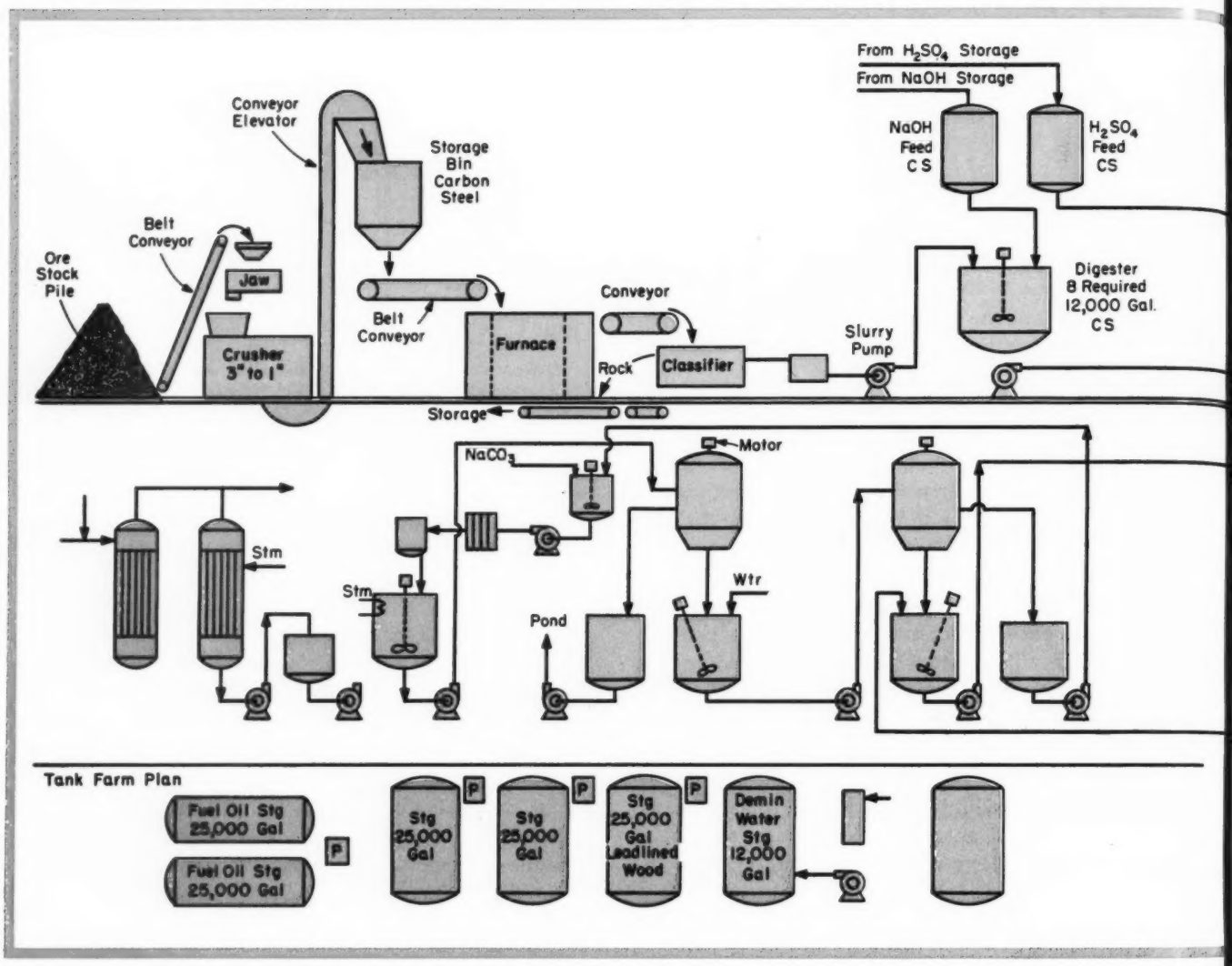


CUTAWAY SHOWS BASIC ELEMENTS OF THE CHEMICAL-TYPE DEHUMIDIFYING UNIT INSTALLED AT HARVEY.

Besides being quite pleased with the new features of their dry swimming pool room, the operators have noticed another important factor. Incidences of colds of swimmers seem to have been reduced. This may be attributable to the dry, Arizona-like climate maintained. More spectators are attending swimming events and staying longer. ▲▲

Surface Combustion

DEHUMIDIFYING UNIT REMOVES 241 GALLONS OF MOISTURE PER DAY FROM THE AIR.



THIS IS A ROUGH LAYOUT FOR THE PROCESS FLOW DIAGRAM REPRESENTING A PROPOSED CHEMICAL PLANT. USING

How We Prepare

Preliminary Estimates

WILLIAM R. CORBETT

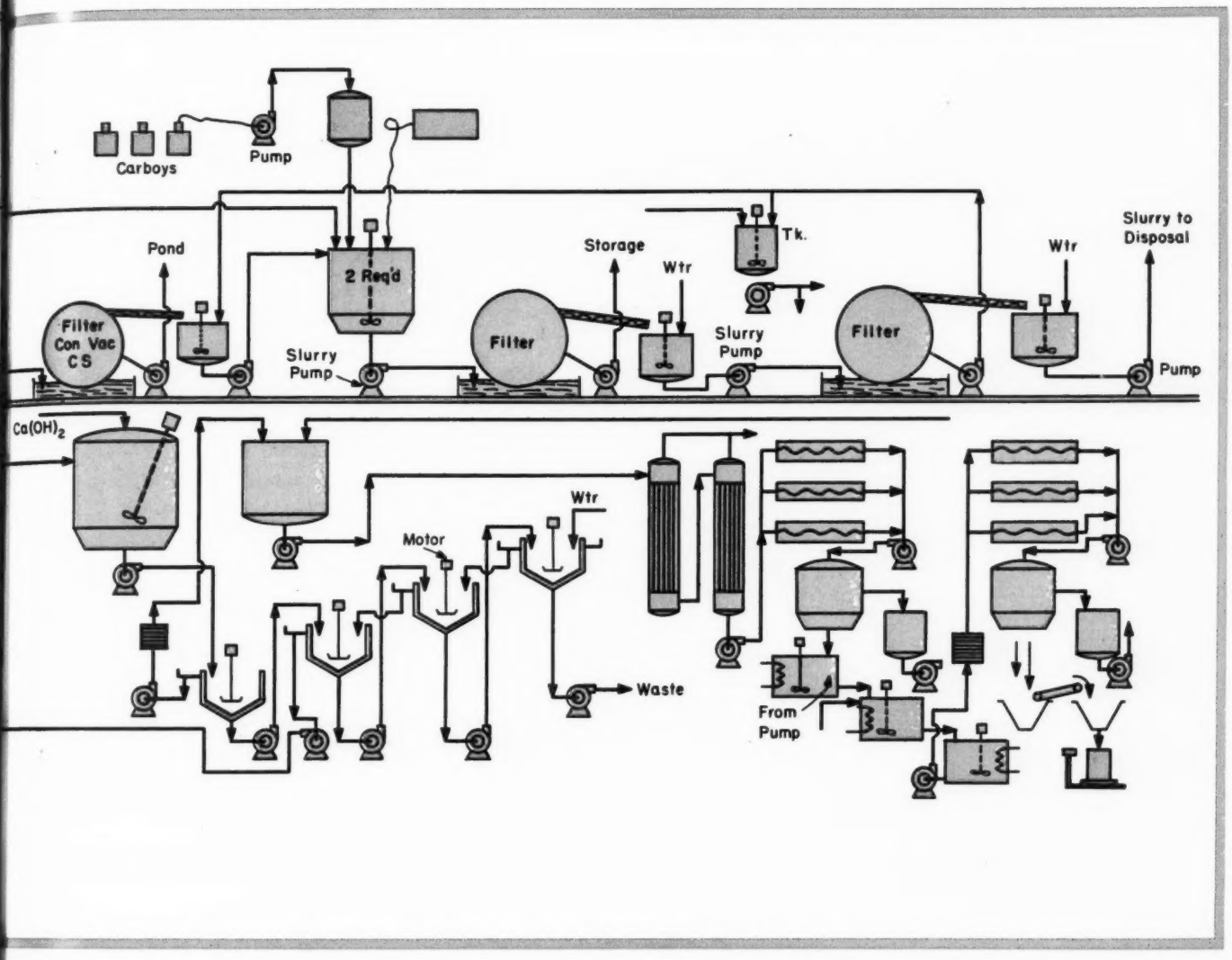
Consulting Engineer

A CONSULTING ENGINEERING firm engaged in the design and construction of plants is continually faced with questions of estimating. A preliminary estimate is by far the most difficult and involved. At the time the preliminary estimate is required, there are very little estimating data available. What does exist can change. Using a multi-million dollar process plant as an example, there is frequently no more than a description of the process, a rough process flow sheet, and some data on the proposed site. These must be developed into an estimated product cost to enable the owner to decide whether the process is the optimum one or whether some modification or other process should be considered, whether or not further research is necessary, which parts of the process are to be abandoned as uneconomical, or whether to proceed as planned with the first rough process layout.

Evaluation of Costs

The preparation of a preliminary estimate calls for evaluating all items of cost from land acquisition to the production cost when full production is reached. All direct and indirect costs are included, not omitting the consulting engineers' costs and fees and the owner's engineering and legal costs.

Land cost is so variable that it is not truly estimated; the cost is obtained from the owner or entered as an allowance. The next item estimated,



THIS LAYOUT AS AN EXAMPLE, THE AUTHOR SHOWS THE GENERAL METHODS OF MAKING UP A PRELIMINARY ESTIMATE.

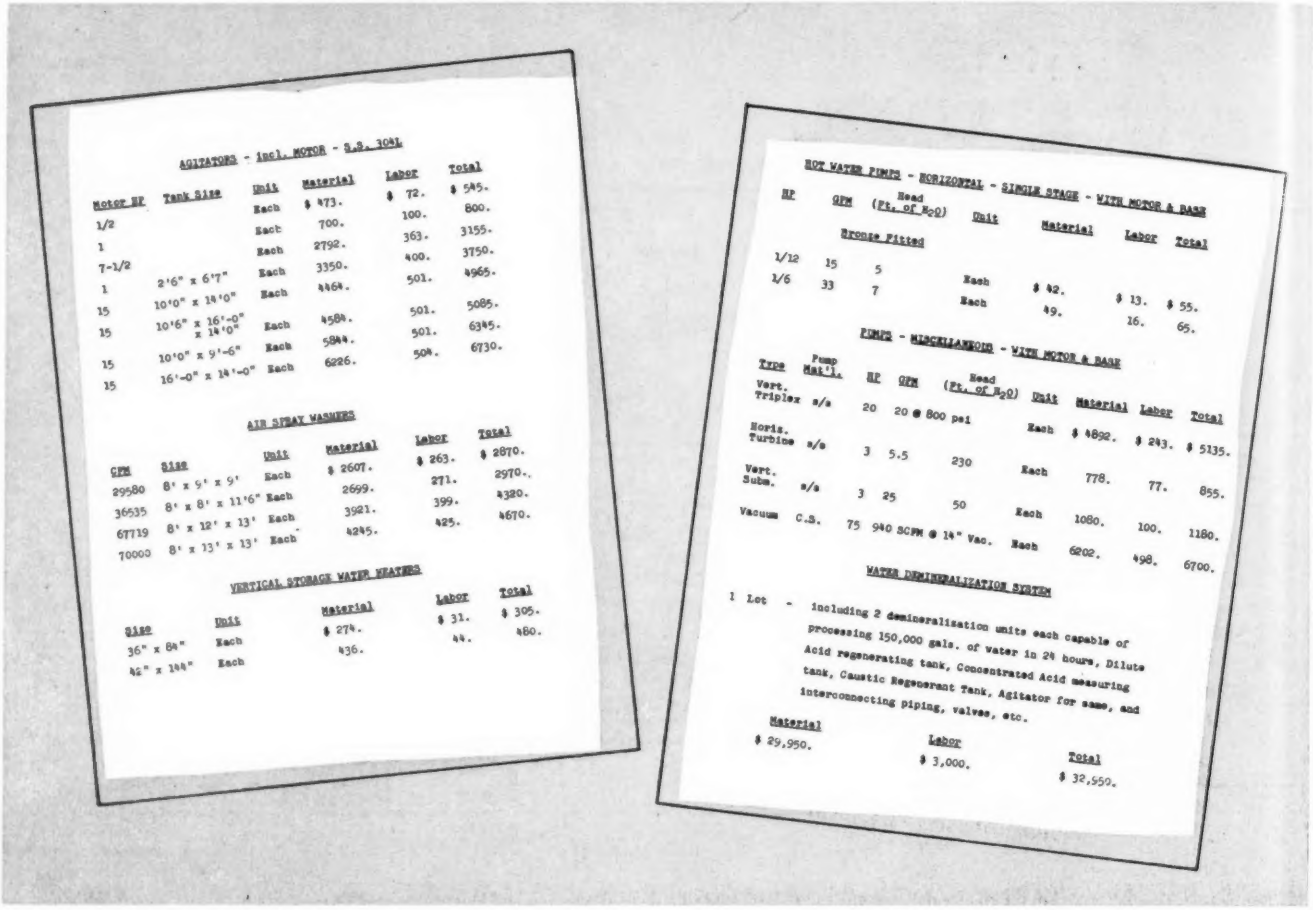
in chronological order, is the initial construction cost of the plant.

The estimate of the initial construction cost is divided into two main parts: process work and building work. The process installation is the heart of the project and is customarily separated into the five process divisions: mechanical equipment, piping, electric power, ventilation, and instrumentation. It generally works out that the process is within the building and that the outside facilities are, in reality, building work, with certain acknowledged exceptions.

The mechanical equipment is the body of the process and all the others are appendages. In a continuous flow chemical plant it consists of tanks, towers, condensers, agitators, centrifuges, pumps, and all other mechanical equipment necessary for the process or auxiliaries. Individual pieces may have appurtenances such as coils, baffles, trays, jackets, or insulation. These details are not shown on the rough process flow sheet; the estimator must obtain them through consultation with the

WILLIAM R. CORBETT
Consulting Engineer

After seven years with Vitro Engineering, William R. Corbett left his position there as supervising engineer of the estimating section to found his own consulting firm. His firm specializes in cost estimating. While at Vitro, he was associated with the design of plant facilities worth almost a billion dollars; these include plutonium production plants at Richland, Wash., nerve gas plants at the Rocky Mountain Arsenal, and titanium plants in Tennessee. Before this, Corbett was chief engineer of A. M. Hazell, Inc. — a firm specializing in New York waterfront plants. He is a registered professional engineer in the State of New York. Corbett obtained his degree in mechanical engineering from Stevens Institute in 1923.



AGITATORS - Incl. MOTOR - S.S. 304L

Motor HP	Tank Size	Unit	Material	Labor	Total
1/2		Each	$ 473.	$ 72.	$ 545.
1		Each	700.	100.	800.
7-1/2		Each	2792.	363.	3155.
1	2'6" x 6'7"	Each	3350.	400.	3750.
15	10'0" x 14'0"	Each	4464.	501.	4965.
15	10'6" x 16'-0" x 14'0"	Each	4584.	501.	5085.
15	10'0" x 9'-6"	Each	5844.	501.	6345.
15	16'-0" x 14'-0"	Each	6226.	504.	6730.

AIR SPRAY WASHERS

CFM	Size	Unit	Material	Labor	Total
29580	8' x 5' x 9'	Each	$ 2607.	$ 263.	$ 2870.
36535	8' x 8' x 11'6"	Each	2699.	271.	2970.
67719	8' x 12' x 13'	Each	3921.	399.	4320.
70000	8' x 13' x 13'	Each	4245.	425.	4670.

VERTICAL STORAGE WATER HEATERS

Size	Unit	Material	Labor	Total
36" x 84"	Each	$ 274.	$ 31.	$ 305.
42" x 144"	Each	436.	44.	480.

HOT WATER PUMPS - HORIZONTAL - SINGLE STAGE - WITH MOTOR & BASE

HP	GPM	Head (Ft. of H_2O)	Unit	Material	Labor	Total
Bronze Fitted						
1/12	15	5	Each	$ 42.	$ 13.	$ 55.
1/6	33	7	Each	49.	16.	65.

PUMPS - MISCELLANEOUS - WITH MOTOR & BASE

Type	Pump Mat'l.	HP	GPM	Head (Ft. of H_2O)	Unit	Material	Labor	Total
Vert. Triplex	s/s	20	20 @ 800 psi		Each	$ 4892.	$ 243.	$ 5135.
Horiz. Turbine	s/s	3	5.5	230	Each	778.	77.	855.
Vert. Subm.	s/s	3	25	50	Each	1080.	100.	1180.
Vacuum	C.S.	75	940 SCFM @ 14" Vac.		Each	6202.	498.	6700.

WATER DEMINERALIZATION SYSTEM

1 Lot - Including 2 demineralization units each capable of processing 150,000 gals. of water in 24 hours, Dilute Acid regenerating tank, Concentrated Acid measuring tank, Caustic Regenerant Tank, Agitator for same, and interconnecting piping, valves, etc.

Material	Labor	Total
$ 29,950.	$ 3,000.	$ 32,950.

FROM EXPERIENCE WITH MANY JOBS, THE ESTIMATOR IN A CONSULTING ENGINEERING FIRM PICKS UP A GREAT AMOUNT OF DATA. THESE SHEETS ARE TYPICAL OF THE ESTIMATOR'S FILE, MAKING PAST EXPERIENCE HANDY.

process engineers or from his own general knowledge of the field.

Pricing of equipment has been fairly well standardized. The material cost of the pieces commonly used is picked from the estimator's files, taken from one of the numerous commercial charts, or furnished by a friendly salesman. Not-so-common equipment is roughly designed and sent out for a quotation. All too frequently, a piece of equipment crops up where further research is necessary for even a rough design; the estimator then makes an educated guess. The installation cost of the equipment is arrived at by taking a percentage of the estimated material cost. The percentage is low for the expensive equipment and vice versa.

Process piping is estimated as a percentage of the installed equipment cost. The percentage varies from 28 to 52 percent. This method is simple and avoids long laborious take-off and unit pricing. It must not be construed, however, that no problem exists. The estimator must use good judgment after studying the materials and methods of jobs for which costs are available.

Electric power is estimated at so much per kva ($40 to $90) or horsepower; process ventilation is estimated at so much per cfm (22¢ to 32¢ and special).

Instrumentation is estimated as a percentage (7 to 10 percent, and becoming higher) of the installed equipment cost. Process instruments are relatively costly and instrumentation installations are quite variable.

The process part of the initial construction cost has been considered first here for the sake of clarity and to emphasize the importance of the process. In practice, both the process and building work are estimated concurrently by specialists in their respective fields.

The building work covers all buildings, facilities, utilities, and services necessary—or desirable—for the process to function, and for the convenience and comfort of the operating force. It includes all architectural and structural features, building plumbing, building electrical work, building heating and ventilation, building equipment, and office furniture and equipment. Clear differentiation should be made between items that are properly items of building cost as opposed to those that are process

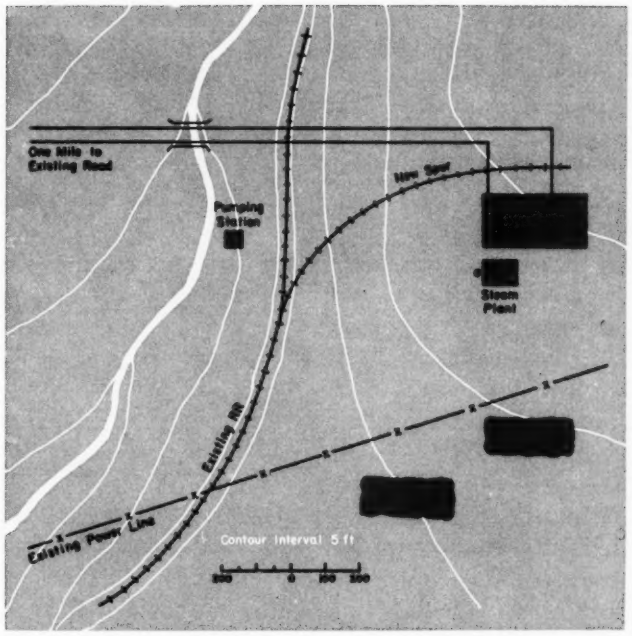
costs. Otherwise the finished preliminary estimate may show the building work disproportionately high and indicate that the project is ill conceived.

The extent of the building work is quite variable, but certain basic components must always be considered. These include the main process buildings, auxiliary process buildings, electrical distribution system, sanitary water system, sanitary sewers, railroads, roads, walks, and fences. Before the building work is priced, it is necessary that layouts of the process features be made, however rough, both on a proposed plot plan and within the plant buildings.

Cubages and Areas

Building cubages and squares as well as distances and areas of outside facilities are obtained from the rough layouts. At this time, added facilities such as gate house, cafeteria, and infirmary are decided upon and sized. Materials of construction, interior finishes, and special features — such as air conditioning or special lighting—are determined from the climate, type of plant, and from the needs of the process and the personnel.

Sizes, materials, and specialties having been established, the building work is ready for pricing. A factory-type building, administrative building, gate house, or other buildings common to the trade are priced on a square foot or cubic foot basis. The units are actual costs of similar buildings taken from the estimating files. Laboratories, cafeterias, and infirmaries are also priced in this manner after careful consideration of the kind of building and its function. Steam plants are priced at so much per thousand pounds of steam produced per hour. Other structures such as open steel frames, pumping stations, or waste disposal plants are given special treatment.



THIS IS A PROPOSED PLOT PLAN. OFTEN, VERY LITTLE MORE DETAIL THAN THAT SHOWN IS AVAILABLE.

Outside facilities are priced per lineal foot or square foot on a generous basis. Experience dictates that plant appurtenances have a tendency to expand while being designed. Outside facilities are given less careful treatment than structures because their total cost is most often less than the cost of one of the main process buildings. Occasionally, however, an individual item is one of the most

—Continued on page 78

Job XX—Chemical Plant

SUMMARY OF PRELIMINARY COST ESTIMATE

	Material	Labor	Total
1. Site Work	$ 179,300	$ 160,700	$ 340,000
2. Building Construction	574,100	527,700	1,101,800
3. Overhead Cranes — Process	42,300	22,400	64,700
4. Process Equipment	370,100	43,500	413,600
a) Blend System	25,800	4,200	30,000
b) Make-up System	20,900	3,700	24,600
c) Feed System	51,800	8,000	59,800
d) Extract System	92,600	6,000	98,600
5. Building Equipment	481,100	328,100	809,200
6. Process Piping	51,800	37,300	89,100
7. Auxiliary Process Piping	427,300	405,700	833,000
8. Heating & Ventilation — Bldg.	88,000	67,000	155,000
9. Process Ventilation	885,100	613,500	1,498,600
10. Instrumentation	4,233,200	1,803,000	6,036,200
11. Process Power	18,200	32,700	50,900
12. Lighting — Bldg.	10,400	10,000	20,400
13. Telephone & Signal Sys. — Bldg.			
14. Direct Cost	$7,552,000	$4,073,500	$11,625,500
15. Indirect Cost (100% of Labor)			4,073,500
16. Construction Cost — Sub-Total			$15,699,000
17. Contingencies (10% Direct Cost)			$ 1,162,500
18. TOTAL — Construction Cost			$16,861,500

THIS IS A TYPICAL SUMMARY SHEET FOR A PRELIMINARY ESTIMATE. BUILDING AND PROCESS COSTS ARE SEPARATED.

Ultra-Violet Products

MANY IMPORTANT MINERALS CONTAIN PHOSPHORESCENT OR FLUORESCENT PIGMENTS. OIL AND MINING COMPANY PROSPECTORS USE ULTRA-VIOLET GENERATORS TO DETECT THESE MINERALS.

Working With Ultra-Violet Light

CE exclusive

FRANK CHARITY

ULTRA-VIOLET energy, sometimes referred to as "black light," is electromagnetic radiation in the frequency range between visible light and gamma radiations; it is generally classified into three types: long-wave, actinic, and short-wave.

Because of its ability to tan or pigment human skin, radiation of the actinic type is most commonly referred to when the term "ultra-violet" is used; it has wave lengths of about 2500 to 3500 angstrom units. Short-wave ultra-violet, having wave lengths in the 1000- to 2500-angstrom range, will not pigment human skin, but it is capable of producing bactericidal reactions that are, among other things, of value in the medical profession. Long-wave ultra-violet has wave lengths in the 3500- to 4000-angstrom range; it is perhaps the most practical member of its family for industry because it has no pigmenting or bactericidal effects.

The carbon arc lamp is probably the first man-made generator of ultra-violet radiation. But since its output is scattered over the entire ultra-violet spectrum (like the ultra-violet output of the sun), it produces too many unwanted or unnecessary rays to be of value for most industrial uses.

In the "hot-quartz" generator, ultra-violet rays are produced by passing an electrical discharge through vaporized mercury. This is a practical method of producing rays with a specified wave length (or frequency), but it is relatively inefficient because it involves high current at high voltage.

The most commonly-used ultra-violet generators at present are of the "cold-quartz" type. They are the same as hot-quartz generators except that their quartz discharge chambers contain ionizable gases such as argon to facilitate the transmission of current. This minimizes electrical requirements and enables the generators to operate at temperatures that rarely exceed 100 F.

Industrial Testing

For industrial test purposes, ultra-violet is most useful because of its ability to energize or activate fluorescent and phosphorescent materials. In the Zyglo process, for example, this characteristic makes

it possible to observe minute surface cracks and other flaws that could not normally be seen in metallic and nonmetallic products. The process involves these steps:

¶ Immersing the products in an oil-base fluorescent penetrant

¶ Superficially cleaning the products so that the penetrant will be retained only by surface flaws

¶ Exposing the products to long-wave ultra-violet radiation.

If flaws exist, the ultra-violet rays will cause any penetrant remaining in the flaws to glow so brightly that the defects can be clearly observed.

Quite frequently, quantities of fluorescent or phosphorescent materials existing naturally in a product will permit the use of ultra-violet radiations for inspection purposes. For example, virtually all important mineral deposits contain fluorescent or phosphorescent materials that glow in the presence of "black light." Engineers in the oil and mining industries now make extensive use of a portable generator to test soil specimens and ores.

Fluorescent materials can be purposely incorporated in some products to permit quick and accurate testing with ultra-violet radiations. One company now incorporates fluorescent pigments in fungicidal varnishes, which are essential to the protection of electronic components in tropical areas. Evidence of poor coverage can be readily observed simply by exposing the applied coatings to ultra-violet light.

Two major rubber companies use fluorescent additives in liquid nylon when the nylon is applied to alternate layers of rubber in the manufacture of fuel cells. This makes it possible to detect possible sources of dispersion leaks.

Since "invisible" smears of glue on raw wood surfaces can spoil the appearance of transparent finish coatings, a number of furniture manufacturers now use fluorescent pigments in their adhesives. This enables workers to inspect bonded wood products under ultra-violet rays and to remove undesirable smears before applying the finishing coat.

Special Uses

A large metal products manufacturer currently uses "invisible" fluorescent marking on all subcontractors' products that are rejected following batch tests. Later shipments from the subcontractors are inspected with ultra-violet light to see if unscrupulous subcontractors are incorporating rejects in subsequent orders of parts.

A Texas leather processor now has invisible fluorescent letters and numerals applied to the luggage his company makes so that he can determine which of his distributors is responsible if his products are eventually retailed at less than fair trade prices.

There seems to be no end for industrial applications of ultra-violet energy. ▲▲

Ultra-Violet Products

SPECIAL GENERATORS HAVE BEEN DESIGNED TO PERMIT ULTRA-VIOLET TESTING IN LIGHTED ROOMS.

The Rock River Generating Station of the Wisconsin Power and Light Company. Consulting Engineers: Sargent and Lundy, Chicago. Present capacity: 60,000 k.w.

Tomorrow's requirements were very much in the minds of Wisconsin Power and Light Company officials and engineers when they started planning the coal-handling system at their Rock River Station. They combined their own experience with the skill of their consulting engineers, Sargent and Lundy...and the conveyor design "know how" of Chain Belt Company Engineers. The result—a coal-handling system modern as tomorrow, dependable, and trouble-free...one which will be easily speeded up to handle the doubled station capacity required for the future.

It's typical of the benefits to be gained when you add the specialized skills of Chain Belt Conveying Engineers and top-quality Rex® Coal-Handling Equipment to your station-planning team.

When you're going to build a new coal-handling system or expand your present one, put the Chain Belt Conveying Experts to work for you. Just contact your nearest Chain Belt District Sales Office or write to Chain Belt Company, 4797 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT COMPANY

District Sales Offices in all Principal Cities

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Looking Towards Retirement

JACK ALAN JAMES
Edwin Shields Hewitt and Associates
Libertyville, Illinois

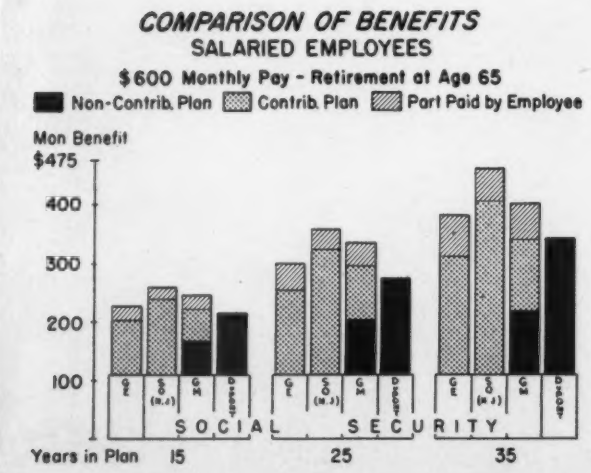
Edwin Shields Hewitt and Associates are independent actuaries, analysts, and consultants in the field of employee benefits, deferred compensation, pension and retirement programs.

THERE IS A GROWING realization that a combination of income taxes and high living costs makes it increasingly difficult for the individual to provide adequately for his old age out of personal savings. This problem has been partly recognized by the rapid growth of employer-sponsored retirement programs and the increased coverage and benefits of Federal Social Security.

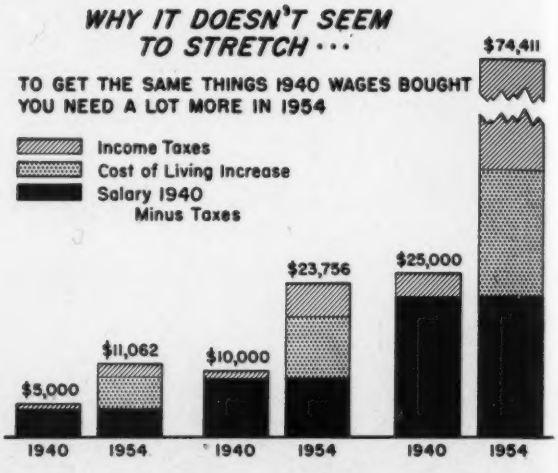
However, while the years since the close of World War II have seen a phenomenal growth in the adoption of employer-sponsored retirement plans in the United States (figures released by the Treasury Department indicate a total of 26,464 plans "qualified" for tax-exemption purposes by the Bureau of Internal Revenue through June 30, 1954, as compared with about 8,000 "qualified" plans at the end of the War), very few consulting engineering firms are to be found among the companies boasting pension plans. In fact, it is doubtful whether an employee retirement program has been even seriously considered by the majority of consultants. This lack is emphasized as the trend continues toward further expansion of pensions in all other fields of business enterprise.

Why have consultants shied away from adopting pensions? Why have they failed to keep in step with the times in offering to their employees (or potential employees) the added incentive and compensation of an adequate retirement program?

Ask a consultant and he is likely to say, "Ours is a young field. Our firm is young and so are our



EMPLOYER, EMPLOYEE, OR BOTH, PAY PLAN COSTS.



TAXES AND INFLATION SQUEEZE DOLLAR EARNINGS.

people. Retirement seems a long way off and we have more urgent matters to worry about."

Another may answer, "A pension plan represents a big commitment. Our earnings history isn't long enough to tell us how much of a load we can afford to shoulder. Give us a little time."

Growing Need

As many leaders in the field adopt retirement plans, other consulting firms will face a dilemma. They recognize that they, too, will need retirement plans to compete for and retain qualified personnel and to meet the growing social pressures on their companies to provide for their older employees.

But, they may well ask, is it feasible for the small organization to adopt a program that may involve large cash outlays and commit the company to a fixed liability in future years?

In the past few years, many new types of plans have been developed that take into consideration the problems of the smaller organization and provide greater flexibility than was previously possible. Whether these plans will fit the needs of a particular consulting organization will depend on its size, ownership status, financial condition, earnings record, age of employees, stability of employment, and other factors.

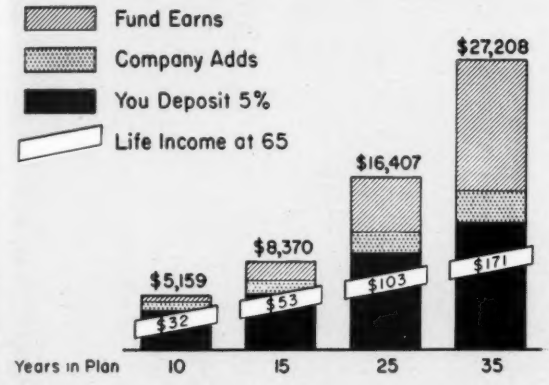
And, of course, the objectives of various employers and groups of employees can differ widely. Nor are all plans intended to produce the same result. For some, the primary concern is to effect changes in the form of compensation. This may produce a program more attractive to employees through some type of deferred compensation, usually involving employment contracts, stock bonus, or stock option plan. More generally, the need will be to arrange for the orderly retirement of employees whose productive capacities are lessened by age in their later years.

There are several widely accepted programs designed to cover a larger group of employees than ordinarily covered by a deferred compensation plan. It must be kept in mind, however, that none of these plans, if they are to have a tax-exempt ruling by the U.S. Treasury, permit participation by the owners or partners in an unincorporated organization. The reason for this ruling is to prevent the owners of a firm from using the tax-exempt privilege as a loophole to escape paying taxes on their personal income or earnings.

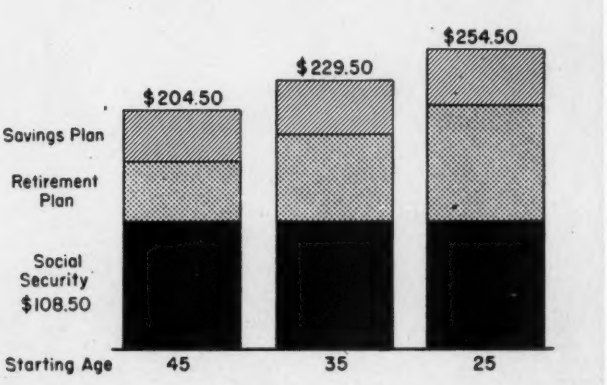
The Savings Plan

The Savings Plan, sometimes called a "thrift" plan, usually involves the smallest cash outlay on the part of the employer. The purpose of this type of program is to assist the employee in his personal savings, with tax advantages for both employer and employee. Under this plan, an employee elects to contribute a percentage of his pay, approximately 1 to 5 percent, to the plan. Usually the company adds 25, 50, or 100 percent of the employee's contribution. If this plan is qualified under the Internal Revenue Code, the employer's contribution is deductible when paid and not taxable to the employee until received. Each plan member has an "account" which is paid out in the event of his death, disability, termination of employment, or retirement. Provision for payment in the event of financial need can also be made.

The savings plan offers an incentive to employees to save for future needs and involves a minimum company contribution. It has the definite disadvantage of not providing adequate retirement benefits for employees retiring in the early years of



FUNDS ACCUMULATE RAPIDLY IF STARTED EARLY.



INTEGRATED PLANS GIVE SUBSTANTIAL BENEFITS.

the plan, since it does not build up large accounts until it has been in operation for a period of years, nor does it provide for the retirement needs of those employees who do not participate.

This type of plan relates company contribution (and, as a result, the benefits) to company earnings. If the plan is qualified by the U.S. Treasury as a tax-exempt employees' trust, it must not discriminate in favor of higher compensated employees or supervisory employees, and must contain a formula for company contributions that is mathematically determinable. Profit-Sharing plans offer a number of advantages:

a. Employer contributions are tax deductible when made.

b. The amounts allocated to individual accounts of participants are not taxable to them until they are received as benefits.

c. Each employee has an account in the plan in his name, which tends to enhance its acceptance.

d. Participants may be permitted to borrow from their accounts in the case of financial need or hardship, as long as appropriate provisions for repayment are made.

e. Participants may be permitted to select investments for their particular accounts.

f. Withdrawals are permitted under certain conditions or provisions of the plan.

Limited or Integrated

The profit-sharing plan, as is also true in the case of a pension plan, can be limited to employees whose compensation exceeds a stipulated amount. It can also be integrated with other qualified or unqualified deferred compensation plans.

A profit-sharing plan builds a constantly increasing reserve for the employee to meet future emergencies. It is also relatively flexible when compared to most other plans.

The profit-sharing method, like the savings plan, fails to build up large accounts until it has been in operation for several years. This again works to the disadvantage of older employees nearing retirement age when the plan is established.

The Pension Plan

The funded pension, as opposed to profit sharing, provides one of the most effective methods of meeting the retirement problem of most companies and provides a great deal of flexibility in meeting its liabilities. The term "funded" refers to money set aside or invested to provide a future fixed guaranteed income—it is the same principle as purchasing insurance. Present Treasury regulations allow considerable latitude in the annual contributions. It is possible to make large contributions in profitable years and minimum payments in lean years. This enables the company to build up a cushion in good profit years to carry over into other years.

The qualified pension plan, funded through a trust or annuities, offers the following advantages:

a. The company contributions are deductible at the time they are paid.

b. The employee pays no income tax on benefits until he actually receives them.

c. Earnings on the fund are tax-exempt.

d. Money paid into the fund irrevocably belongs to the participants.

e. A full pension can be provided to all employees even though some members may retire in the early years of the plan.

It is also possible to establish an unfunded (i.e. no money is set aside but obligations are met from

—Continued on page 80

JACKSON, TENN. HOSPITAL, CONSTRUCTED WITH AIR-ENTRAINED CONCRETE.

Air-Entrained Concrete

A Look at the Record

HARRISON F. GONNERMAN

CE exclusive

Harrison F. Gonnerman, of Oak Park, Illinois, is a consulting engineer and research consultant. He is a graduate of the University of Illinois, receiving his BS in 1908, and his MS in 1913. He stayed at the University as an instructor and assistant professor of research until 1918, when he entered private practice in Los Angeles, California. He was Director of Research and Assistant to the Vice President of the Portland Cement Association until 1952.

Mr. Gonnerman is the author of numerous papers, bulletins, and discussions on cement, concrete materials, and the testing of reinforced concrete. He was awarded the Wason Medal for noteworthy research by the American Concrete Institute in both 1929 and 1944. He is also the recipient of the Sanford E. Thompson Award (1952) from the American Society for Testing Materials.

Mr. Gonnerman is a member of many learned and scientific societies, including the American Association for the Advancement of Science, American Concrete Institute, and American Society of Civil Engineers.

AIR-ENTRAINED CONCRETE is concrete in which controlled amounts of air have been purposely introduced either by intergrinding suitable amounts of certain air-entraining materials with the cement clinker or by adding these agents in suitable and controlled amounts during the mixing of the concrete. In contrast to the air in ordinary concrete, which occurs in relatively large and isolated bubbles in the amount of 1 or 1½ percent by volume, the additional air (2-5 or 6 percent by volume) that is purposely introduced into air-entrained concrete occurs in the form of well-distributed, minute, disconnected bubbles which have significant effects on the properties of both the plastic and the hardened concrete.

The air bubbles purposely introduced into air-entrained concrete are relatively stable like those formed by ordinary soap. They are produced by

the foaming of the air-entraining agent during agitation of the concrete in the process of mixing with water. Commercial air-entraining agents in current use are soluble soaps (or form soluble soaps) which foam readily during the mixing of the concrete. The many small and well-distributed bubbles produced by the air-entraining agent act as a lubricant in the concrete and are more effective in this respect than are grains of sand of comparable size.

Measurements indicate that most of the air voids in hardened air-entrained concrete vary in size from a few ten-thousandths to about two-thousandths of an inch. It has been calculated that as many as 400 to 600 billion air bubbles are entrained in a cubic yard of concrete containing entrained air in the amount of 3-6 percent by volume.

The air voids serve as reservoirs to accommodate expansion resulting from the freezing of water within the concrete. As freezing within the capillaries progresses, the expansion pressure is relieved as the excess water is forced into the air voids where expansion can occur without disrupting the concrete. When thawing occurs the capillary forces and the air compressed in the voids force the water to move back into the capillaries. The air voids continue to function in this manner during repeated cycles of freezing and thawing.

Air-Entraining Materials

A number of satisfactory air-entraining materials are available for the production of air-entraining cements and air-entrained concrete. Materials that have been used for the purpose include the following general types:

¶ Natural wood resins

¶ Animal or vegetable fats and oils and their fatty acids, such as stearic and oleic acids

¶ Various wetting agents, such as the alkali salts of sulfated and sulfonated organic compounds

¶ Water-soluble soaps of resin acids and animal and vegetable fatty acids

¶ Miscellaneous materials such as the sodium salts of petroleum sulfonic acids

In addition, hydrogen peroxide and aluminum powder have been used to entrain gas (oxygen or hydrogen) in concrete.

Entraining Methods

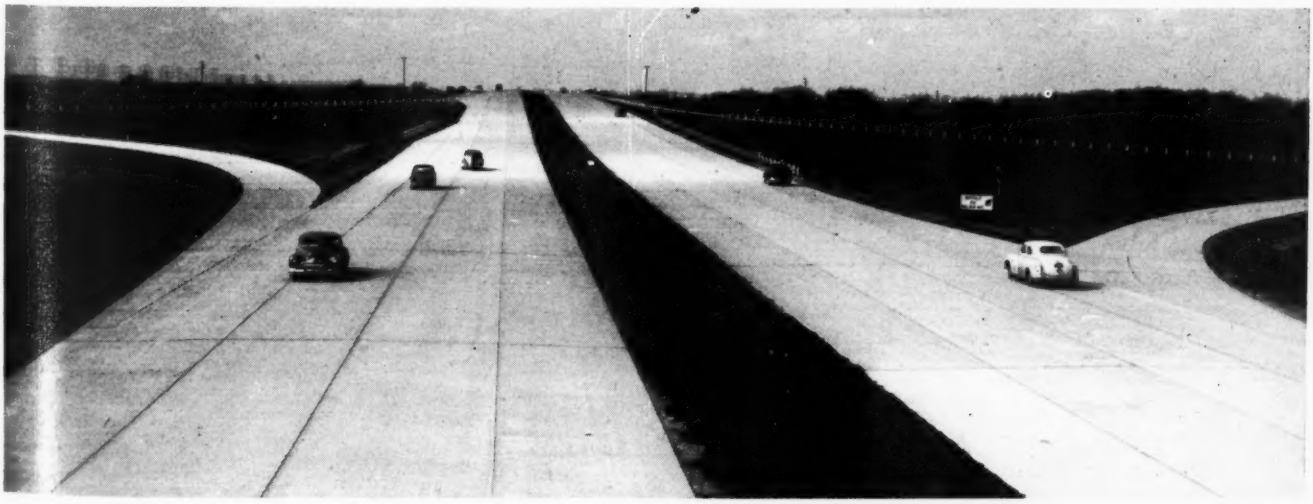
Introduction of the air-entraining materials into concrete is accomplished in two ways—by intergrinding with the cement clinker; or by adding directly to the batch of concrete materials at the mixer, either in powdered or paste form or in a solution in water or other liquids. The amount of material required to entrain the desired amount of air in the usual paving and structural concrete mixes is small and ranges from about 0.01 to 0.05 percent by weight of the cement.

Air-entraining cement contains a fixed amount of air-entraining agent which determines the amount of air that will be entrained in the concrete. The air content can be varied somewhat by making adjustments in one or more of the variables that influence air content, provided that such adjustments do not violate any of the provisions of the basic specifications.

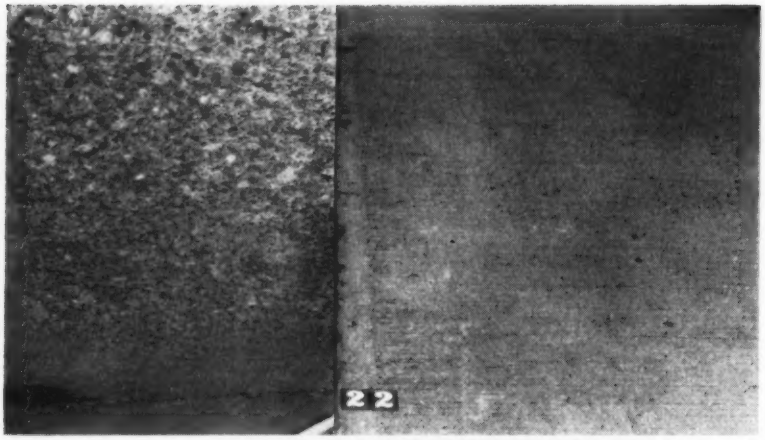
When air-entraining admixtures are added at the mixer, the air content of the concrete can be adjusted, as conditions may require, during the progress of the work. Continuous supervision is required to insure that the desired amount of air is obtained at all times.

Many engineers favor the use of the air-entraining cements to eliminate the need for addition of a fifth ingredient at the mixer. Also the practical problems involved in adding such active materials as air-entraining materials on the job are avoided.

The addition of materials such as tallow fat, oil,



VIEW OF PORTION OF NEW YORK STATE THRUWAY CONSTRUCTED OF AIR-ENTRAINED CONCRETE. THIS CONCRETE IS MORE RESISTANT TO SCALING CAUSED BY APPLICATION OF SALT OR CALCIUM CHLORIDE TO REMOVE ICE.



SURFACES OF EXPERIMENTAL PAVING PROJECTS AFTER EXPOSURE TO SALT ACTION AND FREEZING AND THAWING.

CLOSE-UPS AT LEFT SHOW SURFACES OF ROAD AFTER 12 YEARS. AIR-ENTRAINED SAMPLE SHOWS LESS SCALING.

BELOW, VIEWS OF EXPERIMENTAL ROAD IN CHICAGO. AIR-ENTRAINED PORTION IS IN GOOD SHAPE AFTER SEVEN YEARS. STANDARD MIX SCALED IN TWO YEARS.

and resin to mortars and concretes to increase their plasticity, placeability, and resistance to penetration of water is not new. It appears to have been practiced for many centuries. It is reported that the Romans made use of hog's lard, curdled milk, and ox blood in stucco mixtures.

Dr. Bryan Higgins, in 1780, recounted his experiences with the use of skimmed milk, ox blood, linseed oil, olive oil, and powder of resin in sand-lime mortars. He also mentioned "oil cements."

The first serious attempt to evaluate the properties and performance of concrete mixed with oil appears to have been that of Logan Waller Page, when he was Director of the Office of Public Roads. Results of Page's tests were first published in 1911, although a paper briefly describing the work had been presented earlier. Page's interest in oil-mixed concrete was aroused while experimenting to develop a nonabsorbent, resilient, and dustless road material capable of withstanding the severe shearing and raveling action of automobile traffic. He found that where a heavy mineral residual oil was mixed with portland cement paste, it entirely disappeared in the mixture and furthermore did not separate from the other ingredients after the cement had become hard. Recognizing the possibilities of oil-cement mixtures for waterproofing purposes, he began extensive laboratory tests to determine the physical properties of concrete and mortar containing various quantities of oil admixtures. His specifications for oil to be used in oil-cement concrete required among other things that the oil be a fluid petroleum product with no admixture of fatty or vegetable oils; also that a mixture of one part oil to two parts of 0.01 normal caustic soda show no emulsification when shaken. These requirements were intended to eliminate compounded products or certain straight petroleum residuals which readily emulsify with alkali, entrain air, and reduce the strength of mortar and concrete.

Page reported that both laboratory and service tests definitely demonstrated the value of oil-mixed concrete in damp-proof and waterproof structures. He found that an admixture of oil in proper amount was not detrimental to tensile strength of mortar and that compressive strength of mortar and concrete was not seriously reduced by the addition of oil to the concrete.

Concrete mixed with oil required a longer time to set hard then did plain concrete, but the increase in strength was nearly as rapid in the oil-mixed as in the plain concrete. Concrete and mortar containing oil admixtures absorbed almost no water and under low pressures were waterproof. Bond tests showed the advisability of using deformed bar reinforcement in oil-concrete mixtures. Page's experience with oil-mixed concrete in pavements, in roofs, and in tanks is reported in Bulletin 230, of

the United States Department of Agriculture.

In a paper published in the Proceedings of the American Concrete Institute, in 1926, Prof. A. H. White and J. H. Bateman discussed the use of soaps as integral waterproofings for concrete. White and Bateman were interested in soaps of the insoluble type that made concrete water-repellent and resistant to the penetration of water. They did not investigate the soaps of soda, potash, and ammonia, which are soluble in water and cause foaming in the mixer and entrainment of air in the hardened concrete.

Finely Divided Soap

White and Bateman found that the effect of soaps, added in small amounts in finely divided form as integral waterproofing to cement mortar and concrete, was to diminish the absorption of water by capillary action to a marked extent and to lessen the permeability to water under pressure. Compressive strength was not materially affected provided the waterproofed concrete was kept damp until it gained the requisite strength, and provided the soap was not one that caused foaming in the concrete mixer with consequent entrainment of air in the finished product.

It is to be noted that Page, and also White and Bateman, were interested only in those additions that would produce a concrete resistant to the penetration of water and at the same time have little or no effect on the strength. The entrainment of additional air in the concrete was deliberately avoided since it was known that this would reduce the strength. These investigators were not aware of the beneficial effects of purposeful air entrainment on the durability and other properties of concrete.

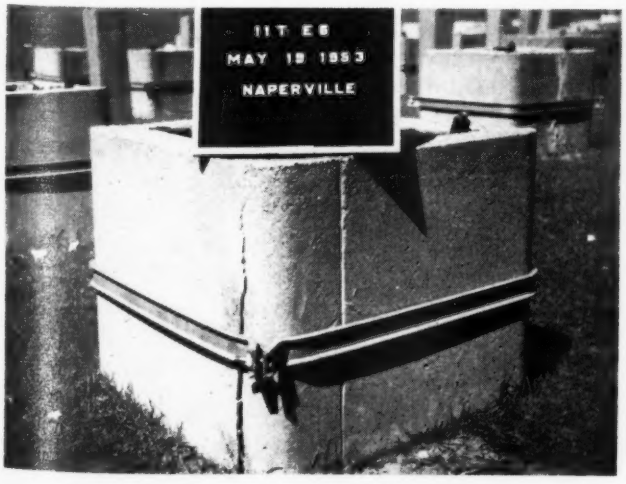
Cements having water-repellent properties produced by intergrinding beef tallow or other suitable materials with the clinker have been marketed for many years. Such cements have been used for their water-repellent and waterproofing qualities rather than for their resistance to severe weathering. They had not been used extensively in pavement concrete but about 1927, a "quick hardening" portland cement of this type was manufactured for use in pavements and structures. A patent for this cement was issued on March 3, 1931.

It is of interest that tests of 20 portland cements manufactured in 1904, — so-called "old-fashioned" cements, showed that seven of the cements contained an amount of an air-entraining material which would in all probability have been sufficient to have produced air-entrained concrete. The air-entraining material was no doubt "crusher oil" that had leaked from the grinding mills during grinding of the clinker. Laboratory and field tests of concretes containing crusher oil have shown that in suitable amounts it is an effective air-entraining agent for cement.

Scaling of Concrete Roads

Surveys of concrete pavements made in the late twenties and early thirties in certain of the northern states disclosed the occurrence of scaling of the surface of the pavement as a result of the direct application of flake calcium chloride or rock salt to remove ice or the repeated use on icy pavements of abrasives such as sand or cinders that had been treated with either salt or calcium chloride. The extent and severity of the scaling depended upon the amount of chemicals used and the frequency of their application. Scaling generally occurred only at those locations where heavy or frequent applications of the chemicals were made —at intersections, on grades or curves, and at other locations where good traction is required.

About that time highway engineers became interested in the problem, and in 1930, through an appropriate committee of the Highway Research Board, a study was begun to develop information



TEST BOX MADE WITH AIR-ENTRAINED CONCRETE HAS BEEN EXPOSED IN TEST PLOT FOR 12 YEARS.

BOX MADE WITH NON-AIR-ENTRAINED CONCRETE DOES NOT STAND UP TO WEATHERING AS WELL.

on the most effective and economical methods to use in dealing with the problem of icy road surfaces, to determine the proper quantities of materials or combination of materials to use, and to study the damaging effects of chemical thawing agents on concrete pavements. Tests were made of certain coatings applied to the surface of the hardened concrete to prevent or minimize scaling of the surface under such conditions.

In May 1936, the Research Laboratory of the Portland Cement Association began studies in the laboratory on:

(1) Methods of treating the surface of existing concrete pavements to prevent scaling caused by the application of chlorides during icy weather

(2) The factors that reduce the tendency of concrete surfaces to scale when subjected to solutions of calcium and sodium chloride

The tests under (1) included studies of many different surface coatings and surface treatments applied to concrete slabs that were subjected to freezing and thawing and to wetting and drying tests of all types.

Tests under (2) involved extensive laboratory and field studies. Studies were first made on the resistance of concrete to freezing and thawing in tap water and in a 10 percent calcium chloride solution, and to surface scaling when sodium and calcium chlorides were used to remove ice frozen on the surface of the test specimens. Tests were made with different types of cement, cements ground with various grinding aids, and blends of portland and natural cement. Further studies were made to determine the effect of fineness of cement, grading of sand, water-cement ratio, curing of the concrete, admixtures, surface finishes, and placing methods. Later, tests were made with air-entrained concretes produced from air-entraining cements, with non-air-entraining cements to which air-entraining agents were added at the mixer, and with blends of air-entraining and non-air-entraining cements.

Grinding Aids

In the course of these laboratory studies an investigation was made in November 1937, of 11 different materials representative of most of the types available to the cement industry for use as so-called "grinding aids" in the grinding of cement clinker. Several of these materials permitted reductions in the water content, reduced the bleeding, and markedly increased the resistance to freezing and thawing of concrete specimens made from the cements in which they were used. These beneficial effects appeared to have resulted from the increased amount of air entrained in the concrete by the cements ground with those grinding aids that entrapped air during mixing of the concrete. The favorable results obtained in this study led to more intensive laboratory tests of the possible benefits to be obtained from the purposeful entrainment of air in concrete. The results of these various laboratory studies laid the foundation for large-scale field tests of air-entrained concrete in numerous experimental highway projects constructed from 1935 to 1942, in several of the northern states and in other types of structures erected in various locations in the United States.

Experimental Roads

New York State was the first state to experiment on a large scale with concrete pavements in an effort to solve the scaling problem. During 1935, 1936, and 1937, New York State constructed 13 experimental concrete pavements in 13 widely scattered counties throughout the State — for a total of 846 miles. These projects were constructed with special, non-air-entraining, commercial portland cements of varied chemical composition, since the effect of cement composition on pavement performance was the principal variable then under study. Blends consisting of five or six bags of these various portland cements mixed with one or two bags of two brands of natural cement manufactured in New York State, were also used in these experimental pavements.

These projects revealed no relationship between surface scaling and composition of the cement, but they did show clearly that portland cement that inadvertently contained "crusher oil" reduced surface scaling as did many of the blends of portland and natural cement that contained tallow added during grinding of the natural cement. Laboratory tests disclosed that the beneficial effect of the crusher oil and the tallow was due entirely to the additional air entrapped in the concrete by these air-entraining agents.

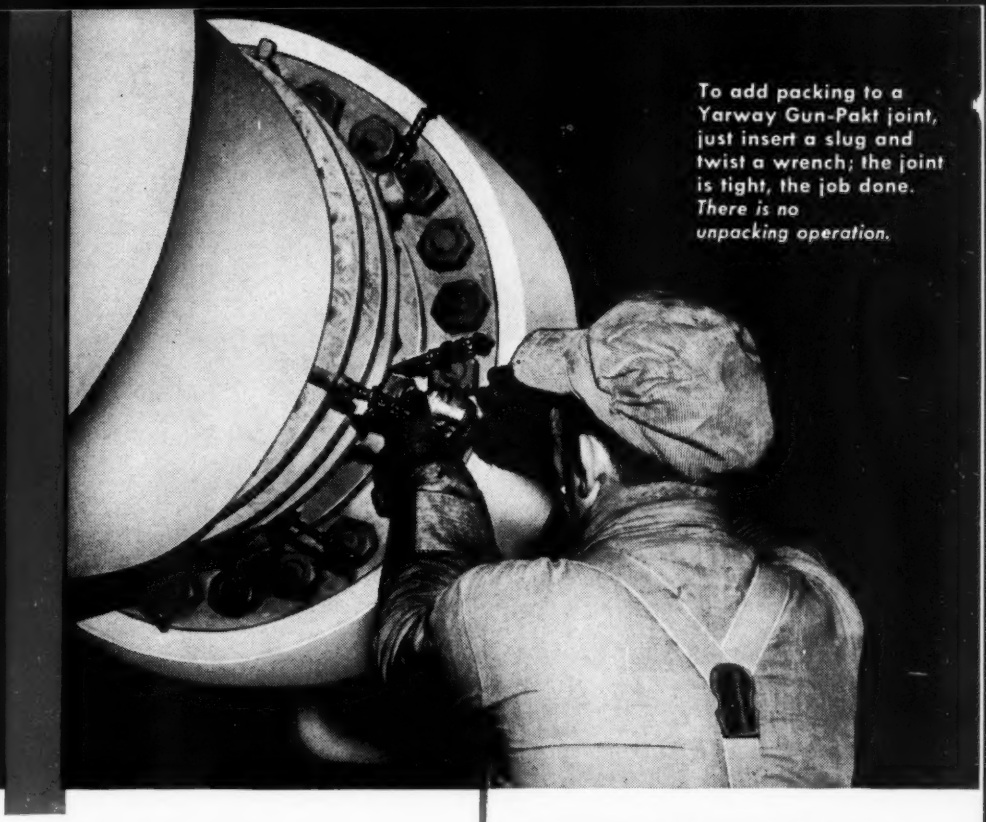
Later Experiments

In order to extend and verify the laboratory and early field findings on the benefits of air-entrained concrete, other large-scale experimental highway projects were built with commercial air-entraining cements in which some of the air-entraining agents that had been investigated in the laboratory were purposely interground with the cement. These roads were built during the period 1938-1942 in Illinois, Indiana, Kentucky, Maine, Massachusetts, Michigan, Minnesota, New York, Ohio, Pennsylvania, Utah, and Wisconsin. The performance of all of these projects, so far as surface scaling and resistance to freezing and thawing is concerned, has been outstanding. Many thousands of miles of pavement built with air-entrained concrete since 1940, have shown equally good performance.

In 1954 thirty-two state highway departments were specifying air-entrained concrete for their concrete pavements, and eleven others specified it under certain conditions. Many of these states

STARTLING NEW FACTS ON EXPANSION JOINT MAINTENANCE

It may cost less than you think to service expansion joints. Look at these records from three typical users of Yarway Gun-Pakt Expansion Joints:



To add packing to a Yarway Gun-Pakt joint, just insert a slug and twist a wrench; the joint is tight, the job done. *There is no unpacking operation.*

	YARWAY GUN-PAKT JOINTS	CONVENTIONAL GLAND-PACKED JOINTS
STATE UNIVERSITY*	Required addition of only 3 slugs (45 cents) of packing in 5 years. Lubrication only once every 6 months. Total labor time of only 2 manhours in 5 years.	Same lubrication as Gun-Pakt, *plus* gland tightening, *plus* complete overhaul with shutdown for unpacking and repacking every 3 to 4 years. Time for overhaul—25 manhours per joint!
MID-WEST AIRFIELD*	Only maintenance was lubrication and addition of 2 slugs (30 cents) of packing per year. Total labor ¼ manhour per joint per year.	Lubrication and gland tightening required 8 manhours per joint per year—plus complete unpacking and overhaul every 2 to 3 years. Time required for overhaul—20 manhours per joint.
"BIG TEN" UNIVERSITY*	Lubrication only once every 2 months, with packing added as needed. Total labor time charged, 1 manhour per joint per year.	General maintenance requires 6 manhours per joint per year. Complete overhaul required every 2 to 3 years with unpacking and repacking—24 manhours per joint.

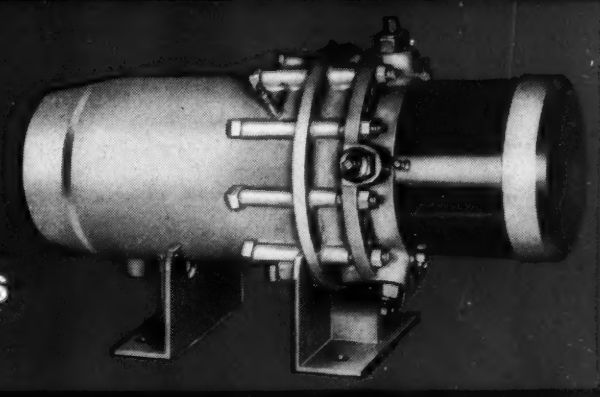
*Names on request.

To get the full facts on Yarway Gun-Pakt Expansion Joints, and how they can save you maintenance money, write for Yarway Bulletin EJ-1913.

ARNALL-WARING COMPANY
8 Mermaid Ave., Philadelphia 18, Pa.

YARWAY

Yarway single-end, welding type Gun-Pakt joint for pressures to 300 psi, heavier design for higher pressures. Single-end traverses up to 12 inches; double-end up to 24 inches.



gun-pakt expansion joints

specify its use in all bridges and highway structures. It is also specified for appropriate projects by various federal agencies.

Specifications for Cements

Specifications for air-entraining portland cements, that is, cements interground with small additions of foaming agents, were first issued by the American Society for Testing Materials in 1942 (Serial Designation C175). Current American Society for Testing Materials Specifications recognize three types of air-entraining portland cements,—Types IA, IIA, and IIIA. These correspond respectively to Types I, II, and III of ASTM Standard Specification C150, and are used where air-entrainment is desired in addition to the other properties of a particular type. The chemical requirements of the three types of air-entraining portland cements are the same as their corresponding types of non-air-entraining cements. Federal Specification SS-C-192a provides for air entrainment in each of the five types of portland cement covered by that specification.

In addition to the specifications for air-entraining portland cement, the American Society for Testing Materials has issued tentative specifications for air-entraining natural cement (C10-52T) and for air-entraining portland blast-furnace slag cement (C205-53T).

Currently shipments of air-entraining cements amount to about 10 percent of the total U. S. shipments for all types of portland cement.

Specifications for Concrete

Specifications for air-entrained concrete have not as yet been issued by national specifying agencies. Bulletin No. 13-R of the Highway Research Board, entitled *Current Road Problems,* May 1950, brings together the best practices prevailing throughout the country in the use of air-entrained concrete and the most widely accepted methods of test and control.

A total air content of from 4-5 percent by volume gives satisfactory improvement in durability without serious loss in strength, particularly if advantage is taken of the greater workability of the air-entrained concrete to reduce the sand and water content of the mixture. Experience has shown that from 3-6 percent total air constitutes a reasonable working range for control purposes. A number of state highway departments have adopted these limits in their specifications for air-entrained concrete for pavements and bridges. These same limits are usually acceptable for other types of construction although for reinforced concrete structures a somewhat higher upper limit than 6 percent has been permitted without detriment to the concrete. The 3-6 percent air limits are intended to apply to concrete in which the volume of mortar is approxi-

mately 0.5 to 0.6 of the volume of the concrete. Where the volume of the mortar is appreciably more or less than this, the percentage of air should be increased or decreased accordingly.

Uses of Air-Entrained Concrete

During the development of the use of air-entrained concrete for pavements, experience and tests showed that such concrete has many desirable properties that make its use advantageous in other types of construction such as concrete buildings, bridges, dams, tanks, silos, masonry units, pipe, and other precast concrete members.

Among the advantages of purposeful air-entrainment are:

¶ Greatly increased resistance to disintegration by frost action and to scaling caused by the direct application of salt and calcium chloride to remove snow and ice

¶ Increased workability and placeability

¶ Increased cohesiveness and reduced tendency to segregation and honeycombing

¶ Reduced amount of water for a given slump

¶Reduced passage of water through concrete

¶ Reduced bleeding, water gain, and sand streaking

¶ Compensation for deficiencies in grading of sand

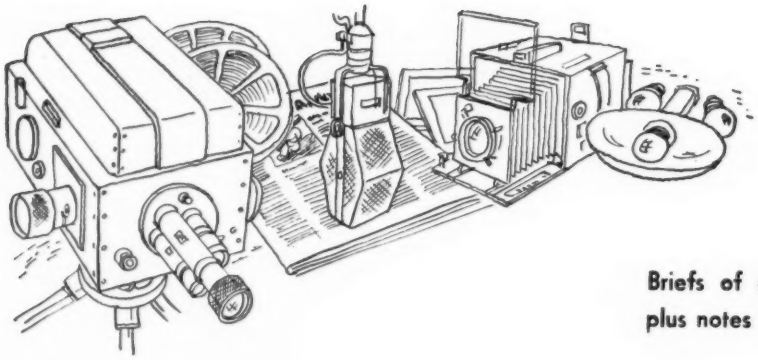
¶ Improved resistance to sulfate soils and waters

¶ Saving of time in handling, placing, and finishing

¶ Greater uniformity in texture, color, and appearance of the concrete.

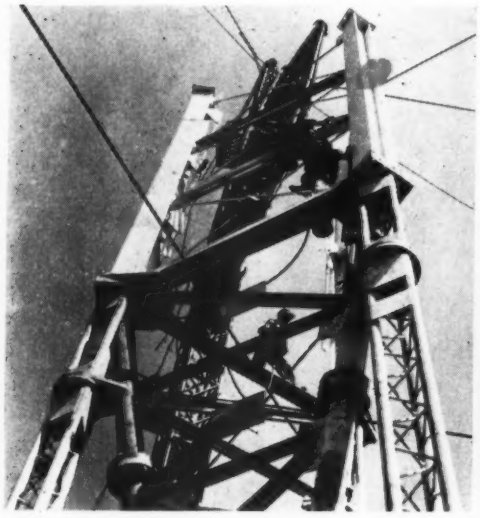
The introduction of additional air into the concrete tends to reduce the strength, bond, and abrasion resistance of the richer mixes. However, beneficial effects all tend to produce a more homogeneous and durable concrete and better-appearing concrete structures. These advantages far outweigh any reduction in compressive, flexural, or bond strength.

The development of air-entraining cements and air-entrained concrete constitutes a very important milestone in cement and concrete technology. Its outstanding benefits have aided greatly in the production of better and more durable concrete structures. However, it should not be regarded as a cure-all, and the care and precautions used with non-air-entrained concrete also should be used with air-entrained concrete. Only sound, durable and properly-graded aggregates should be used. The mix should be properly designed. Full advantage should be taken of the reduction in water-cement ratio that can be obtained with air-entrained concrete. The air content of the concrete must be maintained within proper limits—it cannot be left to chance. Tests for air content preliminary to construction and routine tests for control purposes during construction should be required. Simple apparatus is available for the rapid and accurate determination of the air content of concrete during placing in the field. ▲▲



NEWS

Briefs of current interest to the consulting profession plus notes on new equipment in the field of engineering



LEFT, STATION KWTV'S TOWER DURING CONSTRUCTION: RIGHT, WORKMEN EASE FIRST SECTION OF WWJ-TV'S TOWER ONTO PEG WHICH IS FOCAL POINT.

TV Tower Tops Empire State by 100 Feet

To give increased range and coverage to TV station KWTV at Oklahoma City, Okla., Ideco Division of Dresser-Stacey Co. designed and fabricated a 1420 ft tower (left) and topped it with two antennas, 70 ft and 73 ft, for a total height of 1572 ft—100 ft higher than the Empire State Building.

The tower is triangular in section, 12 ft on a side, tapering at the base to rest on circular steel slabs supported by a huge porcelain insulator made up of 21 oil-filled porcelain tubes, each four inches in diameter and forming a unit capable of withstanding a crushing load of 5600 tons.

The 675 tons of steel making up the detail elements were shop welded and shipped to the site for field erection by bolting.

Ideco estimates it used close to 11,000 lbs of Lincoln Electric Company's new iron powder electrode, Jetweld, in manually welding flanges, platforms, and wing plates to the leg sections. Some of the heavier flanges required as much as 40 lbs of electrode and 40 to 50 passes inside the bore and out.

Two legs and the bracing of each section, most of them 30 ft long, were bolted together on the ground and then hoisted into position by an electric gin pole—a 10 ft all-welded boom fitted with an electric winch inside its latticed structure. Once the two legs were in place and the flanges bolted, the remaining leg was hoisted and the bracing bolted to its wing plates. In all, there were 52 individual tower sections.

Not quite so high, but still the highest man-made structure in Michigan, is the tower for Detroit's station WWJ-TV designed by Blaw-Knox Co. Unusual feature of the 1063½ ft tower (including antenna) is the electric manlift incorporated in the tower itself. Lift control is accomplished by means of low frequency inductive carrier signals thus eliminating the usual two-wire electric control circuit and related equipment. The system was engineered and manufactured by Union Switch & Signal Div. of Westinghouse Air Brake Co.

While the tower for KWTV at Oklahoma City tapers to rest on steel slabs supported by a porcelain insulator, this tower's focal point (for 300 tons pressure) is the three inch diameter steel peg welded to a five inch steel base plate. The composite insulator (for the 1572 ft tower) and the base plate (for the 1063½ ft tower) rest on foundations of concrete and reinforcing steel.

Nuclear Development Committee Organized

Under sponsorship of Engineers Joint Council, a General Committee on Nuclear Engineering and Science has been created to "meet the pressing problems of nuclear engineering and the related sciences."

EJC, made up of engineering societies with a total membership of 170,000, has been joined in the project by the American Chemical Society, which has 70,000 members. Dr. John R. Dunning, dean of engineering at Columbia University, is chairman of the committee and Dr. Donald L. Katz, of the University of Michigan, is secretary and program chairman. Organizations of physicists and others concerned with industrial nuclear development have been invited to participate.

The committee is planning a Nuclear Congress to be held July 11-16, 1955. However, if the United Nations designates a city in North America for its own nuclear conference in 1955, the Congress will not be held.

NEWS

—Starts on page 62

Prestressed Concrete Beams Form Structural Members and Decks

Prestressed concrete construction besides its usual advantages of durable construction and reduced maintenance costs has, for the type of bridge construction pictured, the added economic advantage of beams that form bridge decks as well as the structural members.

In the picture, a crane swings one of 36 pretensioned prestressed concrete beams into position on

CRANE SWINGS ONE PRESTRESSED BEAM INTO POSITION.

the first Chicago area prestressed concrete bridge, spanning a fork of the DuPage River.

To form the beams, each 3 ft wide, 17 in. thick, and 30 ft long, ¼ in. diameter special high strength strands, manufactured by American Steel and Wire Div. of U. S. Steel, are tensioned at 240,000 lb per sq in. within forms. The strands are then encased in poured concrete.

The bridge, which was designed by O. B. Dold, superintendent of DuPage County Highway Dept., is being built by Advance Construction Co. with Midwest Pre-Stressed Concrete Co. beams.

New Method Controls Conditioning of Concrete Test Cylinders in Field

Winter and summer both pose problems in the curing of concrete test cylinders in the field. In warm weather high temperatures develop from heat of hydration; in cold weather proper curing is retarded by low temperatures.

Under a new method developed by E. W. Zimmerman Co. of Chicago, test cylinders are placed in a ruggedly constructed metal curing can which is lined with a thick layer of Du Pont cellulose sponge. This inner liner permits the absorption of two to four quarts of water with a 60 percent retention after seven days. The bottom of the can has a special gasket that insures a complete seal when the top is in place.

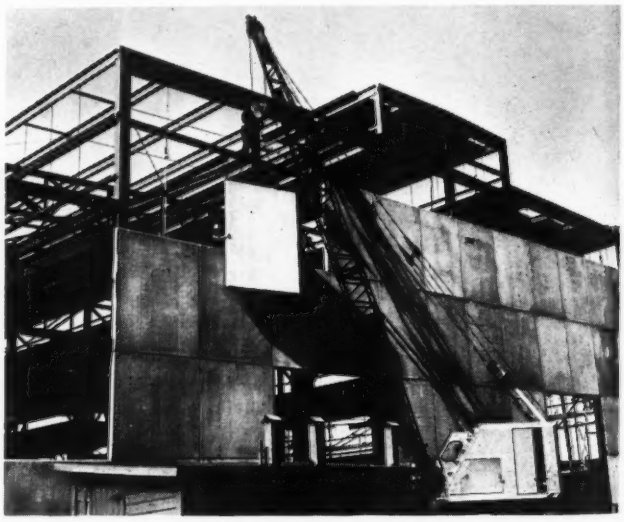
In hot weather, the sponge liner in the curing can is thoroughly saturated with water. Test cylinders are then placed in the bottom of the can, and covered — the saturated condition of the cellulose sponge liner assuring adequate humidity for proper curing. During winter field operations, the liner is used in a dry condition, thus eliminating the retarding of proper curing due to low temperatures.

Precast Concrete Panels Used for Swimming Pool and Building

Whether the construction project is a swimming pool or an industrial plant, one of the first considerations is cost in terms of time, materials, and labor.

Precast concrete wall panels used in constructing Union Carbide & Carbon Corporation's Ashtabula, Ohio plant were erected in less than half the time required for conventional walls by a nine-man crew using a mobile crane.

The panels, manufactured by Marietta Concrete Corp., consist of two layers of wire reinforced concrete around a filling of insulation material — in this case Fiberglas. Metal inserts cast into the panels



APPROXIMATELY 4000 SQ FT PER DAY WERE CLOSED IN WITH PRECAST CONCRETE PANELS BY A NINE MAN CREW.

permit bolting to the metal framework of the building. Panels are tongue-and-groove design. After erection, horizontal seams are sealed with concrete.

Inexpensive construction and flexibility of size have opened up another use for the precast panels — prefabricated swimming pools. Plans for such a pool were worked out by J. Robineau, president of American Pool Co., for the estate of Richard Harte, of Williamstown, W. Va. Professor George E. Large of Ohio State University supplied structural details.

The pool was assembled in six prefabricated wall sections, while the pool floor was laid in place at the site. Each end piece was a solid section, 5 x 20 ft and five inches thick. The two sections on each side

Precast Concrete Panels

—*Starts on page 64*

joined at an L-type concrete bracket midway of the side. Rubber hose material was used to insure watertight joints.

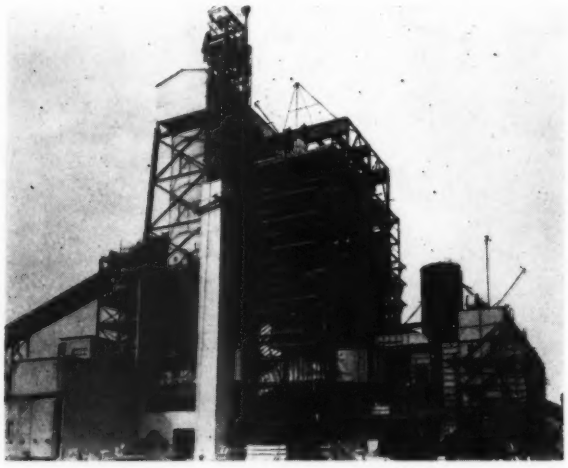
Pool walls were in place in nine hours, including erecting, bolting, lining up sections, grouting, and calking. Total cost for construction, filtration equipment, diving boards, and walkways was only $4500.

Industry Increases Efforts to Combat Air Pollution

Air pollution has become a serious community problem. According to testimony by the Honorable Oveta Culp Hobby, Secretary of Health, Education, and Welfare before the Senate Appropriations Committee in April of this year, the nation faces an increase in pollution directly proportioned to projected increase in manufacturing.

The manufacturing Chemists' Association, Inc. has taken issue with this statement by pointing out the research being sponsored by the chemical industries. MCA estimates that over-all annual expenditures of the industry for pollution control (air and water) are about $40 million.

Research Corp., which markets Cottrell electrostatic precipitators, has released figures showing the



PENNSYLVANIA POWER & LIGHT RECENTLY ADDED TWO COTTRELL PRECIPITATORS AT MARTIN'S CREEK.

strong upward swing toward use of their precipitators to combat air pollution in the power, iron, and steel industries. The figures represent cfm gas cleaning capacity added during each period, and are not the accumulated total.

	1944-1948	1949-1953
Power	12,933,000	39,532,500
Steel & non-ferrous metallurgical	2,338,856	6,477,000

Total gas cleaning capacity of Cottrell units in use is approaching 17 million cfm, and of this total over ⅓ has been added in the last five years. Blast furnace installations account for more than half the total gas cleaning capacity.

Another type of equipment for fighting air pollution has been installed by the V. D. Anderson Co. at a pigment manufacturing plant in St. Louis, Mo. Here, a serious nuisance and fire hazard existed because air vented from the plant by five vacuum pumps contained large quantities of entrained oil. An Hi-eF Line Type Purifier was installed on the manifold from each pump. Discharge lines from the purifiers were then tied into a single outlet header. This installation has paid for itself in six months by reducing maintanance on buildings near by.

Effluent air and gas cleaning equipment has also been announced as a new project for a national committee working under procedures of the American Standards Association. The committee, made up of representatives from national organizations concerned with air pollution, will work out standards of performance for such equipment. The American Society of Heating and Ventilating Engineers and the American Society of Mechanical Engineers have been approved as possible sponsors for the project.

Landing Strip Constructed of Fly Ash Paving Material

You don't have to be in Rome to ". . . do as the Romans do." Some 2000 years ago Romans used volcanic ash in making their highways and aqueducts—some of these are still in use.

Today, construction is well underway on a 3000 ft landing strip at Wings Field, Pa. using a paving composition of fly ash (similar in makeup to volcanic ash) and lime. The new product, marketed under the name Poz-O-Pac, was developed by G. & W. H. Corson, Inc., lime manufacturers, with the cooperation of Philadelphia Electric Co. and John Bright Associates, Inc., consultants for aviation applications of the product.

Installation and materials for the runway are expected to cost 35 percent less than conventional paving with the added advantage of being freeze and thaw resistant and free-draining.

The fly ash, lime, and water are mixed on location and turned into the soil to a depth of about ten inches. Heavy rollers are then used to compact the ground. The materials take several weeks to combine chemically and harden but will bear heavy loads immediately.

Another form of Poz-O-Pac, a heat-resistant top-course paving, using boiler slag instead of earth, was used in making a high-temperature resisting jet acceleration apron at Lambert Field, Mo. This material, in controlled laboratory tests, has withstood 3000 F.

Research on new uses for fly ash in paving and construction now being conducted at the Corson laboratories is expected to signal a new era in road, driveway, and paved-surface construction, according to Dr. L. J. Minnick, chief chemist. ▲▲

EXPERIMENT in adsorption: add tapes made with colloidal carbon to deteriorated oil; stir. Note that Carbon Black *adsorbs* impurities. Clear oil results. In Type CB Cable these carbon-black tapes purify oil by the same process.

"Black Magic" makes this cable last longer

Heat and electrical stress . . . heat and electrical stress . . . keep it up long enough and insulating oil in ordinary paper cable breaks down. The cable may have to be replaced.

ANACONDA Type CB* (Carbon Black) Power Cable is different. Special carbon-black tapes continually purify and stabilize the insulating oil . . . keep oxidation products outside the dielectric field. They stop ionization discharges. "Black magic" insures added life for this superior cable.

For greatly extended sheath life of ANACONDA Type CB Cable, specify ANACONDA F-3** alloy. This superior alloy-lead sheath won't age-harden . . . resists slow-bending fatigue, creep, burst and abrasion. Cable joint sleeves also are available in this same alloy. They all offer higher tensile strength, a 50% higher bursting strength than copper-lead, lower creep rate and similar increased resistance to bending fatigue and vibration.

Ask your Anaconda Representative to show you how this outstanding cable can help give your distribution system maximum service life and economy. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.* 53332

*CB — Carbon Black (U. S. Patents 2,102,129, 2,405,853) Reg. U. S. Pat. Off.
**F-3—Arsenic-Lead Alloy (U. S. Patents 2,300,788, 2,375,755, 2,504,600 and 2,570,501) Reg. U. S. Pat. Off.

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Service and overhead distribution cables, bare and weatherproof, including ACSR • signal, control and communication cable • portable cords and cables • network cables • airport and series lighting cables • mine cables • magnet wire • copper, aluminum and copperweld conductors • wire and cable accessories.

MEN IN ENGINEERING

★ Dr. Raymond C. Johnson, as an associate on the technical staff of the Lummus Co., will have as his primary responsibility the development, coordination, and supervision of all activities involving work in the company's laboratories.

★ Kenneth Brunner is appointed chief construction engineer for the association of J. S. Hammel and A. A. Dorman, Los Angeles. Brunner was formerly a design engineer with Koebig and Koebig, of Los Angeles.

★ Walter L. Cisler, president of the Detroit Edison Co., is this year's recipient of the American Society of Mechanical Engineers' George Westinghouse Gold Medal Award for service in the power field of mechanical engineering.

★ Sam Tour, president of Sam Tour & Co., Inc., has been awarded an award of merit by the American Society for Testing Materials "for long and fruitful service to the Society . . ."

★ Dr. William R. Hainsworth is appointed vice-president in charge of the Research Division of The Fluor Corp., Ltd. Lee Van Horn, formerly vice president in charge of Research & Development, has assumed duties of vice president in charge of Process & Development.

★ George H. Elliott, senior partner of George H. Elliott & Co., of New York, is elected chairman of the board of the Research and Development Corporation of America. Orlo A. Ewing, recently manager of manufacturing at Corry-Jamestown, is elected president of R&DCA.

★ Walter A. Shewart, research statistician with Bell Laboratories of New Jersey, receives the Holley Medal from the American Society of Mechanical Engineers. The citation accompanying the Medal honors him for "leading his colleagues in the applications of latent but potent methods of statistics to the problems . . . of manufacturing and industrial research."

★ Daniel, Mann, Johnson & Mendenhall, architectural and engineering firm of Los Angeles, have been retained by Kaiser Aluminum & Chemical Corp. to conduct a nation-wide survey to study and evaluate present and potential uses of aluminum in school construction.

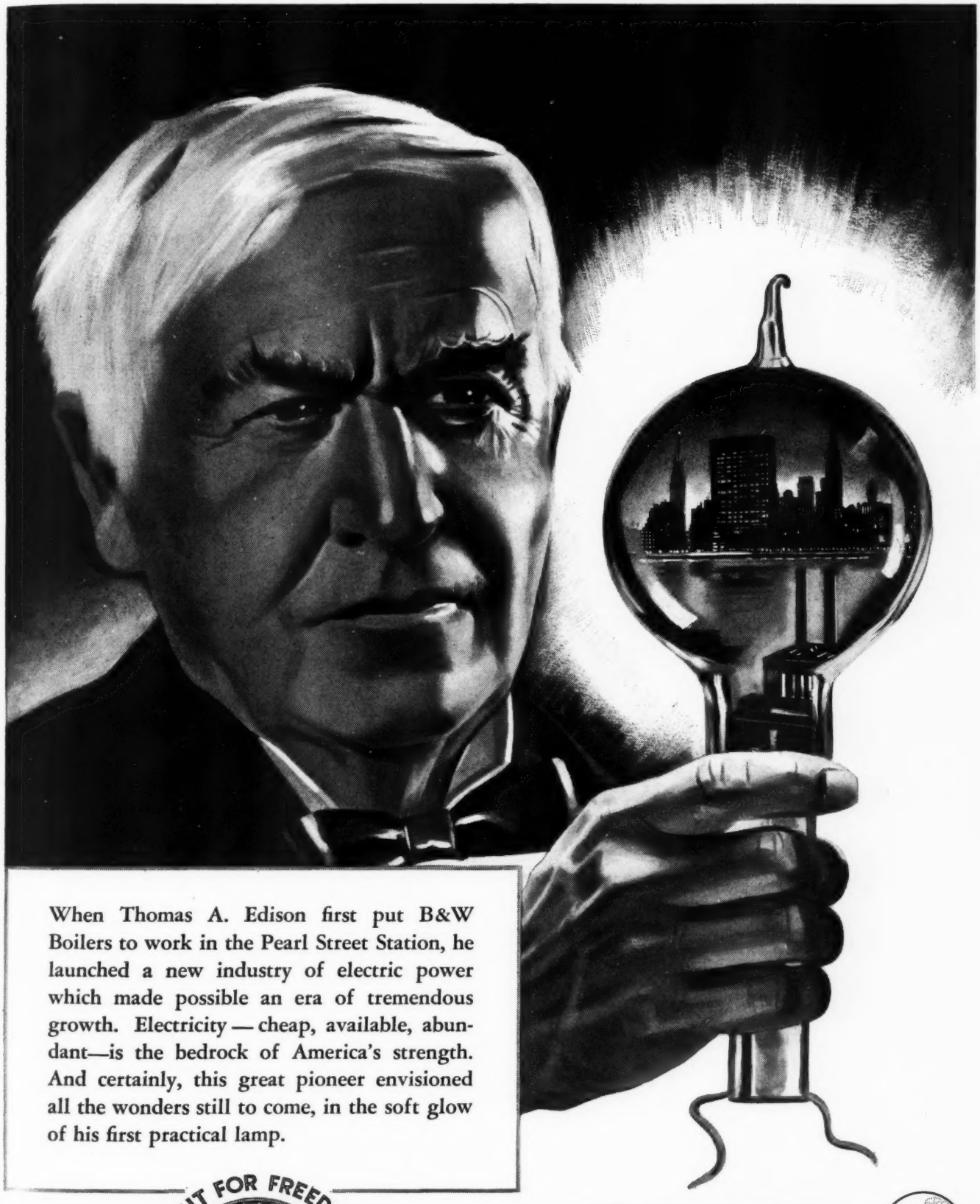
★ Byron Jackson Co. takes another step in the expansion of its Electronic Division with acquisition of the Rollin Co. of Pasadena, Calif. Paul C. Holmes, formerly president of Rollin, is named general manager of the BJ Electronic Division and will head the expanded activity.

★ Edwin B. Powell, consulting engineer with Stone & Webster Engineering Corp., will receive the American Society of Mechanical Engineers Medal, at the annual meeting in New York, for distinguished service in the field of steam power generation.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
75th ANNIVERSARY
1880-1955

THIS DESIGN TOOK FIRST PRIZE

★ For this design, symbolizing a nuclear energy cycle of the present superimposed on a Carnot thermodynamic cycle of the past, and their effect on the world in which we live, Andrew T. Lemmens, design engineer with the Gleason Works, Rochester, N. Y., received first prize in the contest to find a suitable symbol and motto for the 75th anniversary celebration in 1955, of ASME.



When Thomas A. Edison first put B&W Boilers to work in the Pearl Street Station, he launched a new industry of electric power which made possible an era of tremendous growth. Electricity — cheap, available, abundant—is the bedrock of America's strength. And certainly, this great pioneer envisioned all the wonders still to come, in the soft glow of his first practical lamp.

LIGHT FOR FREEDOM
LIGHT'S DIAMOND JUBILEE
1879 1954
POWER FOR PROGRESS

BABCOCK & WILCOX
BOILER DIVISION

N-187

MEN

—Starts on page 68

★ LeRoy Crandall, Frederick Barnes, Leopold Hirschfeldt, and Russell C. Weber have formed the firm of LeRoy Crandall & Associates for the practice of consulting foundation engineering. Offices are located at 1614 Beverly Boulevard, Los Angeles 26, Calif.

★ John P. Baird Jones is appointed to the staff of Foster D. Snell, Inc. as technical representative for the company in British Columbia. Offices are at 627 Vancouver Block, Vancouver, British Columbia.

★ Harry L. Shirk, who has spent most of the past 17 years with Gibbs & Hill, Inc., is appointed manager of the Indianapolis office, succeeding the late James J. Sloyan who died last March.

★ Sol Pincus, Consulting Sanitary Engineer, formerly of the World Health Organization, is taking part in the International Congress on the Underdeveloped Areas of Italy, to be held in Milan, October 10 to 16. His paper will be "The Problems of Sanitation and Engineering in the Underdeveloped Areas of Italy."

★ Mellon-Stuart Co., Pittsburgh contracting engineering firm, announces election of H. A. Saurbrey to the newly-created position of executive vice president.

★ Kaiser Engineers Division of Henry J. Kaiser Co. announces appointment of Sam Ruvkun and J. E. Hughes as assistants to vice president. Both men are civil engineers.

★ The Rust Engineering Co. of Pittsburgh has been awarded the contract by the city of Erie, Pa. to convert the city's sewage treatment plant to a modified aeration type treatment plant with a normal capacity of 45 mil gal per 24-hr day. The project also includes construction of a small ejector station with a capacity of 100 gal per min, and should be completed in 1956.

★ At Stone & Webster Engineering Corp., Edward E. Bigelow is appointed assistant engineering manager. Since 1941 Bigelow has been structural engineer on many S & W projects throughout the country.

In the Electrical Division, Leslie O. Waite is appointed chief electrical engineer succeeding Raymond R. Wisner, who is appointed consulting engineer.

Thomas A. Fearnside becomes chief mechanical engineer to head the Mechanical Division succeeding Burton C. Mallory, who is named consulting engineer.

BIGELOW BAKER

★ Colonel Philip I. Baker, recently retired from Army service, is the new head of the Structural Division of Carroll E. Bradberry and Associates, consulting engineers, of Los Altos, Calif.

★ Frederick R. Harris, Inc. announces promotion of Eugene H. Harlow, P. E. from vice president to executive vice president. C. J. Murphy, P. E. is elected vice president, and H. B. Sanford, P. E., vice president, will also serve as treasurer of the company.

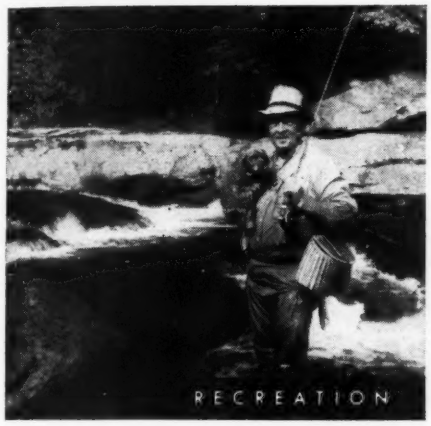
TOUR U.S. PLANTS

Five Japanese engineers of Kansai Electric Power Co., Inc. visit pipe fabrication shops of Dravo Corp. L. to R. are Kengo Emori, Setsuo Fujimoto, Yoshihisa Uchida, C. M. Cooke (Dravo), Shigeo Okano, Isamu Yamasaki, M. R. Haug (Dravo), W. J. Kerchner (Gilbert Associates), and D. W. Fletcher (Dravo). Tour is under supervision of Gilbert Associates, Inc., Reading, Pa.

YOUR NEW PLANT WILL GROW IN THE ERIE AREA

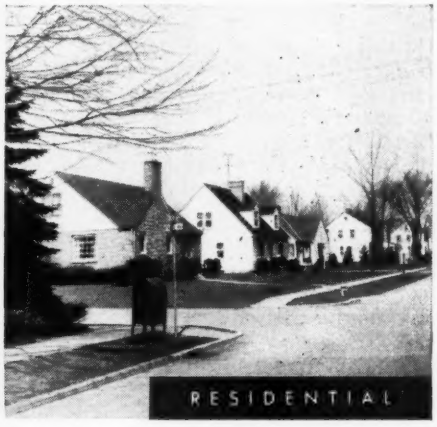
INDUSTRY

New Plant of Harvell Manufacturing Corporation, Hubbard, Ohio, Manufacturers of Decorated Housewares



RECREATION

TRANSPORTATION



RESIDENTIAL

Here's the middle-sized town—right site for your plant!

● Where are the new plants going? Figures show that the middle-sized town is getting the major share because of its opportunities for better living for all personnel.

These pictures from middle-sized towns in the Erie Area, give you some idea of their better life. Their social and recreational facilities make for better human relations—an intangible that finds its way into the company's balance sheet.

Then, of course, industry has room to grow in these middle-sized towns in the Erie Area that fit in with the Government's Dispersal Program.

The Erie Area is in the heart of the nation's largest single market. One-third of America's people live, work and buy here. Raw materials, production and markets are close together.

Industry is served by the dependable Erie Railroad which offers unsurpassed service between New York and Chicago and nationwide by connecting railways and connects direct with New York Harbor for export business.

Our experienced personnel will be glad to discuss desirable locations with you—in strict confidence, of course.

Erie Railroad

SERVING THE HEART OF INDUSTRIAL AMERICA

For more detailed information, send in the coupon below. Your request will be handled in strict confidence—and without obligation.

D. M. Lynn, *Assistant Vice President*
Industrial Development—Room 24-E, Erie Railroad
Midland Building, Cleveland 15, Ohio

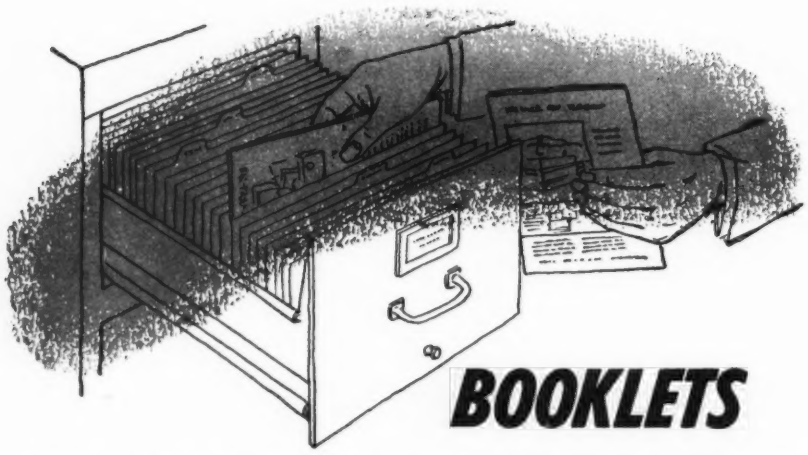
Dear Sir: We are interested. Please send us your Specification Card on which we can list our needs.

Name _____

Title _____ *Company* _____

Address _____

City _____ *Zone* ___ *State* _____



BOOKLETS

Personal copies of booklets can be obtained by writing directly to the manufacturers

"ENGINEERED TIMBER IN THE LIGHT CONSTRUCTION FIELD," by Ralph H. Gloss, engineer on the staff of Timber Engineering Co., is an account of how engineering principles have been applied to construction of homes, schools, recreation buildings, and other similar buildings. *Timber Engineering Co., Dept. CE, 1319 18th St., N.W., Wash. 6, D.C.*

WATER HAMMER—This engineering data book covers the complete subject of cure and prevention of water hammer at the design level. A fold-out sizing procedure section enables any mechanical engineer to size the Shokstop required to prevent any water hammer problem before the building is erected. *Wade Mfg. Co., Dept. CE, Elgin, Ill.*

IF YOU USE EQUIPMENT FOR HANDLING COAL, ore, or other bulk materials you need this 32-page illustrated booklet. It discusses mechanical, electrical, and structural features of such equipment in detail, with photographs of typical installations. *Dravo Corp., Dept. CE, Crane and Bridge Dept., Neville Island, Pittsburgh 25, Pa.*

FLANGE AND COUPLING SELECTOR—This revised edition of the popular Flange and Coupling Selector is in the same easy-to-read slide rule form and provides all the information contained in the earlier selector plus new and useful data. A convenient Pipe Standard Table is incorporated on the selector. *Nooter Corp., Dept. CE, 1400 S. Second St., St. Louis 4, Mo.*

CONCRETE STAVE STORAGE BINS are discussed in this 29-page technical brochure. It contains tables of cubic foot weights of flowable materials, capacities, description of wall construction, test data, and other relevant engineering data with many photographs and line drawings. *The Neff & Fry Co., Dept. CE, 120 Elm St., Camden, Ohio.*

ENGINEERING HANDBOOK 4-8155-G1 is a convenient guide to the design of standard and high capacity drives. The 76-page book includes new horsepower rating tables which permit design or re-design of V-belt drives at lower costs for speed ratings from 100 to 6000 ft per min. Selection, installation, and maintenance are also covered. *B. F. Goodrich Co., Dept. CE, Akron, Ohio.*

THE QUESTION OF HOW COOLING TOWERS SAVE you money is answered fully in four-page booklet 402-A on Flow-Cold Cooling Towers. The five models illustrated and described have capacities from 3 through 15 tons. *Acme Industries, Inc., Dept. CE, Jackson, Mich.*

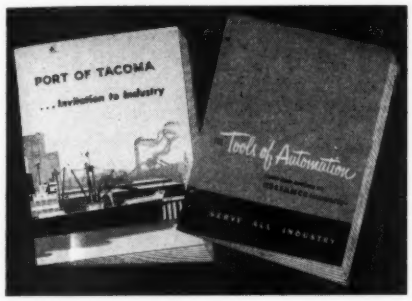
"HELPFUL HINTS ON HAND THREADING Stainless Steel Pipe and Tubing," data card TDC-147 discusses die stock, dies, speed, cutting oils, and the assembly of threaded joints. It is intended to assist pipe fitters working with hand tools on job sites or in provisional field shops away from machine threading facilities. *The Tubular Products Div. of Babcock & Wilcox Co., Dept. CE, 161 E. 42nd St., New York, N.Y.*

THIS INDEX of Honeywell literature on instrumentation has been prepared for your convenience in obtaining data on any of the many products made by this company. To facilitate reference, the index is divided into sections according to the type of bulletin or product. *Minneapolis-Honeywell Regulator Co., Dept. CE, Industrial Div., Wayne and Windrim Aves., Phila. 44, Pa.*

"THE ALUMINUM ASSOCIATION'S ALLOY DESIGNATION FOR WROUGHT ALUMINUM," four-pages, explains the new system of designations for

wrought aluminum and aluminum alloys effective October 1, 1954. Old and new numbers are compared in tabular form. *The Aluminum Association, Dept. CE, 420 Lexington Ave., New York 17, New York.*

SITE LOCATION—Designed to tell advantages of the Port of Tacoma, Washington Industrial Development District, 16-page booklet "Invitation to Industry" is edited for firms seeking industrial site locations in the Tacoma-Pierce county region. Included is a complete current review of shipping facilities of the Port of Tacoma itself. *Port of Tacoma, Dept. CE, P.O. Box 1612, Tacoma, Wash.*



"TOOLS OF AUTOMATION," 12-page booklet A-1555, expresses the philosophy of combining applied engineering, creative thinking, and electric motor drives to provide the "know-how" for automation of single machines or continuous processes. Photos and sketches help tell the automation story. *Reliance Electric and Engineering Co., Dept. CE, 1076 Ivanhoe Rd., Cleveland 10.*

"BULK STORAGE TANKS," 14-pages, points out the diversified uses for these tanks—in industry, air ports, public utilities, railroads, and small business organizations. Specifications are given for horizontal, underground, and vertical tanks and photographs show applications and methods of installation. *Graver Tank & Mfg. Co., Inc. 4809 Tod Ave., Dept. CE, East Chicago, Ind.*

"PRESSURE RECORDERS," 23 page bulletin 6-10, fully explains this company's line of pressure instruments designed for direct measurement, remote transmission, and automatic control. Application chart "How to Select the Measuring Element" shows wide choice of element materials available. *The Foxboro Co., Dept. CE, Foxboro, Mass.*

"UNITED STATES STEEL PRESENTS T-1," 44-pages, introduces Carilloy T-1 steel—a new engineering material of superior strength, toughness, and weldability. Highly interesting to the design engineer, the booklet gives information on the performance of this steel in pressure vessel

BOOKLETS

—Starts on page 72

construction, industrial equipment, and many other uses. *Robert C. Myers, Director of Market Development, Dept. CE, U. S. Steel Corp., Pittsburgh 30, Pa.*

MOTORS—Twenty principal types of improved U. S. motors are illustrated in booklet 1878. This booklet will serve as a handy reference manual on applications of various types of motors and their special design features plus information on Lubriflush transverse bearing lubrication. *U. S. Electrical Motors Inc., Dept. CE, Box 2058, Los Angeles 54, Calif.*

"HYDRO-LINE PUMPS," 11-page bulletin B-1700, completely documents and illustrates construction features of both a process type vertical can pump and a transfer type vertical can pump and points out where each may be advantageously and profitably applied for the handling of hydrocarbons, hot or cold water, mild acids, basic and salt solutions. *Peerless Pump Div., Food Machinery and Chemicals Corp., Dept. CE, 301 W. Avenue 26, Los Angeles 31, Calif.*

WHITE PRINTING MACHINE — The low priced, one-step feed high production whiteprinting machine, known as the Challenger, is described in detail in six-page bulletin 2514. Advanced design features for operator convenience and faster production are pictured. How the unit works, speed of return for different size copies, and an explanation of operation are included. *The C. F. Pease Co., Dept. CE, 2601 W. Irving Park Rd., Chicago 18, Ill.*

ASPHALT PAVEMENT COATING — A four-page bulletin B-23 graphically presents the many functional uses for Colfix Jet Seal, a solvent-resistant coating for asphalt pavements. It includes detailed performance data, specifications data, and complete instructions for applying to existing or new pavements. *American Bitumuls & Asphalt Co., Dept. CE, 200 Bush St., San Francisco 4.*

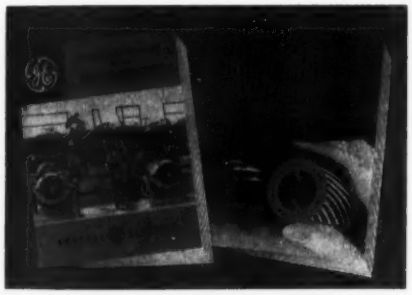
ENGINEERING MANUAL W-317-B17 discusses the modern day trend of completely mechanizing and modernizing sewage treatment plants. How the Comminutor saves time and labor by automatically screening and cutting coarse solids in raw sewage is explained. Advantages, sectional elevations, construction

and maintenance are included. *Worthington Corp., Adv. and Sales Promotion, Dept. CE, Harrison, N.J.*

DRAFTING ROOM EQUIPMENT—Thirty-two-page catalog 14 is divided into three sections for quick location of filing units, drafting tables, or accessories. All items are illustrated, and specifications are concise and simple. *Hamilton Mfg. Co., Dept. CE, Two Rivers, Wis.*

"RLM STANDARD SPECIFICATIONS FOR INDUSTRIAL LIGHTING UNITS," is the third revised addition of this handbook. It is completely indexed as to type of lighting unit and application, and gives luminaire distribution data, light flux values, and coefficient of utilization. *RLM Standards Institute, Inc., Dept. CE, 326 W. Madison St., Chicago 6, Ill.*

"ELECTRIC EQUIPMENT FOR PROCESS INDUSTRIES," 28-page booklet GED-1966A, provides detailed information on: electrical equipment for power generation; power distribution and conversion; power utilization; instrumentation; and lists descriptive publications available. *General Electric Co., Dept. CE, Schenectady 5, N. Y.*



TECHNICAL ASPECTS OF CABLE CONSTRUCTION, line erection techniques, and special accessories are described in 17-page booklet "Alcoa Expanded ACSR for 'Superhigh' Voltage Transmission." Basic research and engineering investigations, laboratory and field trial tests involved in the development of this new conductor for 300 kv and above is told in story form. *Aluminum Company of America, Dept. CE, 732 Alcoa Bldg., Pittsburgh 19, Pa.*

"STEAM-WATER CYCLE DEPOSITS," four-page handbook, gives in table form the mineral name, chemical form, usual area in which deposits are found, normal causes, and some suggested preventive measures. *Allis-Chalmers Mfg. Co., Dept. CE, 948 S. 70th Street, Milwaukee, Wis.*

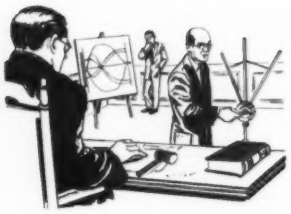
SMALL BOILERS—The recently announced CB50-80 line of small boilers is completely described in four-page bulletin AD-135 with valuable information on design features that enable these boilers to meet your specific requirements. *Cleaver-Brooks Co., Dept. CE, 326 E. Keefe Ave., Milwaukee 12, Wis.*

LIQUID LEVEL INDICATORS — Revised 19-page bulletin WG 1825 describing remote liquid level indicators has been brought up to date with new installation pictures, discussions of the new wide vision dial, and the ASME boiler code application of independent remote level indicators for boiler pressure 900 psi and above. *Yarnall-Waring Co., Dept. CE, Mermaid Lane, Phila. 18.*

METERING — Technical bulletin 115-L3 describes the new short differential producing metering device known as the Dall Flow Tube. The 16-page engineering bulletin includes information on recovery characteristics, applications, accuracy, flow formula, laying length, and working pressure of the device. *Builders-Providence, Inc., Dept. CE, 345 Harris Ave., Providence, R. I.*

PICTURE PROOF OF SAVINGS in time and money using Simplex concrete forms is given in eight-page fold-out. Complete plywood forms and materials for making forms are pictured and described along with hardware and directions for use. *Simplex Forms System, Inc., Dept. CE, 2500 N. Main St., Rockford, Ill.*

GRAVITY FILTERS—Of interest to all engineers dealing with water problems, 24-page bulletin 2539B shows a complete line of gravity filters and filter accessories—manually operated, semi-automatic, and automatic—and includes operating tables. *The Permutit Co., Dept. CE, 330 W. 42nd St., New York 36.*



Engineer-Expert

—Starts on page 32

was supplying useful power to Load X for three-fourths of the entire operating time; during one-fourth of the operating time power was being returned from Load X to Station B.

Station A, however, in supplying electric power to the tie-line at 0.87 power factor was shown to be supplying power to Load X during five-sixths of the operating time; power was returned from Load X to Station A for only one-sixth of the operating time. Thus, during part of the time Load X was returning power to Station B, Station A was still shoving power into Load X and thence to Station B.

The significant feature of the plaintiff's theory is that in the interval represented by the 15-degree difference between the 45-degree power factor angle of Station B and the 30-degree power factor angle of Station A, power from Station A not only flowed into Load X, but combined in part with the power of Load X feeding back to Station B. Hence, a part of the electric power from Station A which flowed to Station B was shown to be able to flow into the franchised area over the proposed new transmission line.

The expert witness for the plaintiff required about two days to present his answer to the hypothetical question. In progressing with his answer, he used twelve sheets of paper, 12 ft by 4 ft, for drawing the necessary diagrams. He used colored crayons to illustrate the electrical characteristics that were basic to numerous types of possible system operations within the power network. These sheets of drawings were marked with identifying numbers and submitted by the attorney as evidence.

During the early stages of his explanations, the expert witness utilized a hand-cranked magneto to demonstrate and clarify the physical meaning of positive and negative power flow. The judge examined the magneto and obligingly turned the crank at his bench while the demonstrations were being made. The expert witness used a mechanical vector analog model to help clarify his suggested methods for controlling the electrical system.

In this trial, the government was clearly shown to be wrong in its contention that power could not and would not flow from its original Station A through Station B and then over the new transmission line into the franchised area.

But, as these types of cases go, involving continuous and mounting pressures by federal agencies, the case was eventually lost by the utility company after several years of sporadic litigation. Thus the processes of long-continued attrition, expensive imported litigation services, granting of special concessions to federal agencies, and use of evasive and shrewd strategy all have had their effects. ▲▲

Engineering Professional?

—Starts on page 36

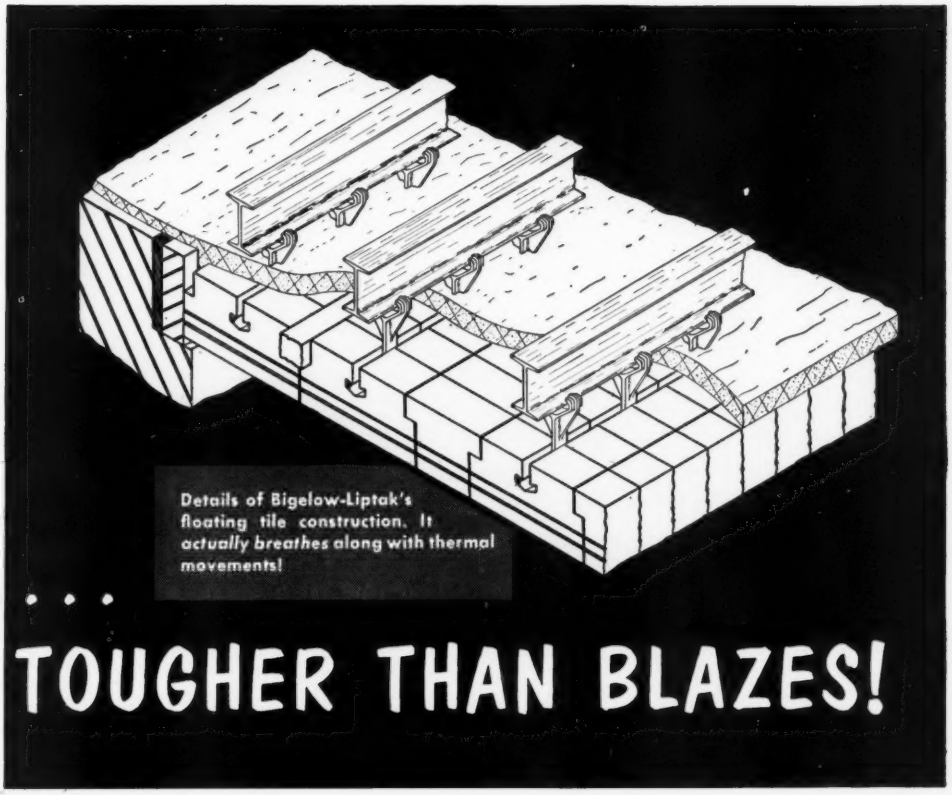
engineering standards would not be lowered if the working philosophy of business further limits the prerogatives of the profession. Economic competition may be the life of trade, but cooperation should play a prominent role in the life of a profession. The engineer, who at present is pressed hard enough by the demands of clients in industry and elsewhere, would be subjected to even greater pressures under the demands of open competition.

Patient, thoughtful analysis of engineering problems would necessarily be affected under the stress of producing cheaper engineering services. The preliminary studies and research — essential to sound, economical engineering planning—would be subordinated to considerations of greater speed. The slick businessman-engineer, specializing in cheap mass-production engineering, could cause exorbitant construction costs with uneconomical design. And, of course, there is the very real danger of unsafe design resulting from engineers being forced away from quality toward quantity production of "engineering."

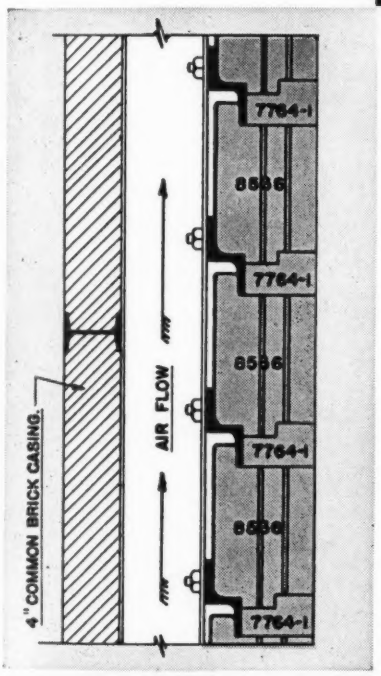
Then there is an objection based upon principle: the right of engineers to certain privileges traditionally accorded by society to professional men in return for their assumption of professional responsibility. If engineers are to assume professional responsibility, then they should not be denied the privileges of professional status. Of prime importance among the privileges of professional status is the right of the profession to lay down a general line of approved ethical procedure in negotiating for the services of its members.

To a suspicious and uninformed minority, the canon forbidding economic competition among engineers is interpreted as a devious method of safeguarding the engineer's schedule of minimum fees. But the vast majority of public agencies recognize the true purpose of the ethical codes as the means of guaranteeing to the public an enduring high standard of technical competence and genuine professional integrity. ▲▲

Suburban Detroit's New Incinerator .... WILL BE TOUGHER THAN BLAZES!



Details of Bigelow-Liptak's floating tile construction. It *actually breathes* along with thermal movements!



Cross section of B-L's wall construction. Note how heavy, heat-resisting castings support the tile.

City planning engineers and consultants will be vitally interested in the fact that Bigelow-Liptak's unique, unit-suspended design for furnace walls and arches makes incinerators "tougher than blazes" too.

Proof of that fact lies in the many B-L installations which dot the country. Right now, in suburban Detroit, Michigan, construction is underway on a large incinerator which features the B-L design.

In a nutshell, unit-suspended construction provides longer, trouble-free life at a lower, overall cost.

Here's why:

1. Each tile is individually supported—there's no "stacked up" burden caused by the ones above it. Thermal expansion is confined to individual tile. Mechanical spalling caused by pinching, buckling, etc. is eliminated. That adds up to no cumulative loading or expansion.
2. If repairs ever become necessary, any small section of tile can be removed and replaced without disturbing adjacent areas. This cuts the size of the repair job as all other areas—above, below, at the sides—need not be touched.

Remember: you'll pay less in the long run. Countless installations in boiler houses, oil refineries, metallurgical furnaces—wherever heat must be controlled—have proven that fact. Write for information—today.

BIGELOW-LIPTAK *Corporation*

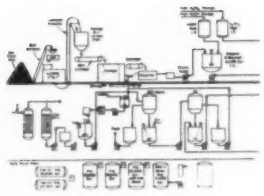
and Bigelow-Liptak Export Corporation

2550 W. GRAND BLVD. • DETROIT 8, MICHIGAN

UNIT-SUSPENDED WALLS AND ARCHES

In Canada: Bigelow-Liptak of Canada, Ltd., *Toronto, Ontario*

ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DENVER • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MINNEAPOLIS • NEW YORK PITTSBURGH • PORTLAND, ORE. • ST. LOUIS • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SAULT STE. MARIE, MICH. • SEATTLE • TULSA • VANCOUVER, B.C.



Preliminary Estimate

—*Starts on page 42*

important parts of the project and is treated accordingly. An example is the electrical distribution system in a plant using an electrical process; it is then estimated as an item of process cost.

The operating costs for the operation of the plant under full production are figured on a per-annum basis. They are separated into direct costs and indirect costs; the direct costs are divided into personnel, raw products, utilities, and the costs of maintenance materials.

The operating section of the firm furnishes the estimator with a list of personnel for direct operation and maintenance; it also designates the duties of each man and the time spent per diem. This list must be tested for completeness and perhaps refined. The personnel cost per annum is figured by adding to the total salaries all necessary charges for holidays, inclement weather, vacations, sickness, and fringe benefits.

The raw products (a sizable item) and utilities are estimated directly from the quantities per annum furnished by the process engineers. The estimate includes the quantities needed for the process plus allowances for loss and waste.

Maintenance materials include all the materials necessary to keep the plant in operating condition—including all spares and spare parts, building service materials, office supplies, and laboratory and infirmary supplies. Each category of maintenance materials is estimated separately.

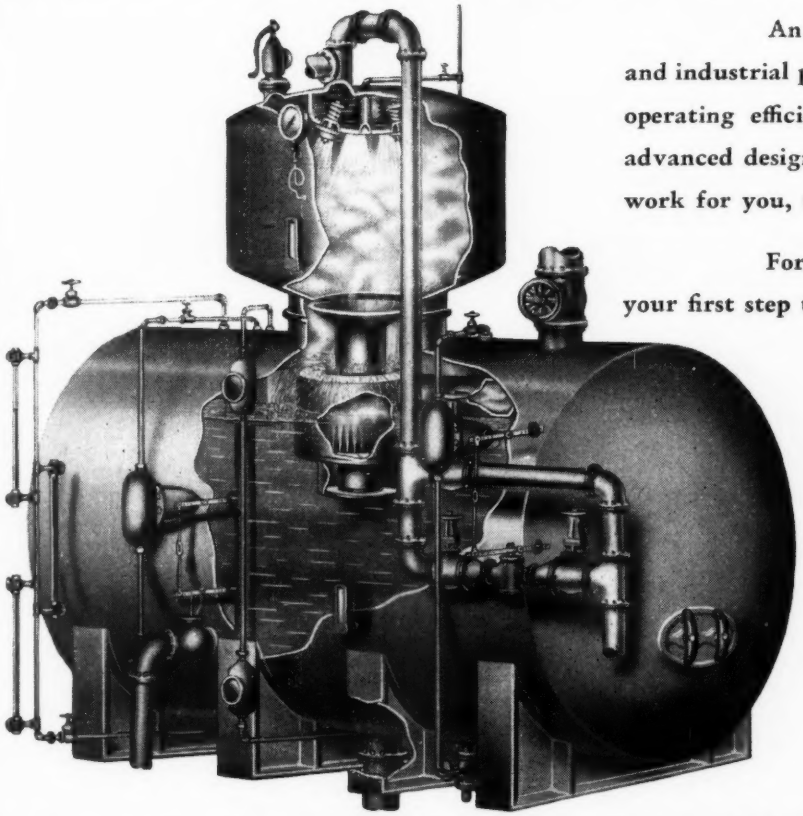
Indirect operating costs cover all the items that service or support the direct operations of the plant. These items include administration, first aid, fire protection, insurance, and taxes. These can be figured in the same manner as the direct operating costs. However, at this point in the preliminary estimate, time is usually important, and the indirect costs can be taken as a percentage of the direct cost after deducting the cost of raw products.

The operating, start-up, construction, and land costs along with their accompanying engineering and legal charges are the components of the product cost. The total cost of the start-up, construction, and land costs are divided by the expected life of the plant in years to get the annual charge for these items. Adding the annual operating cost gives us the total annual charge. This divided by the expected quantity of product gives a result that is the product cost per unit.

The preliminary estimate is done. It is now time for the second guessers. ▲▲

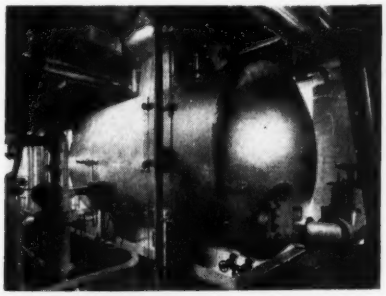
In Deaeration, too

BELCO Builds a Complete Line-

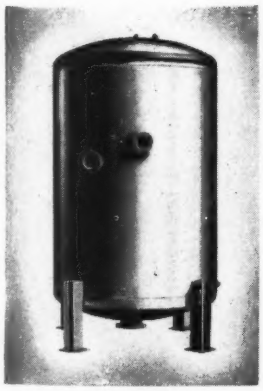


An increasing number of well known utility and industrial plants are using Belco equipment to increase operating efficiency and decrease operating costs. Belco advanced design and application experience can be put to work for you, too.

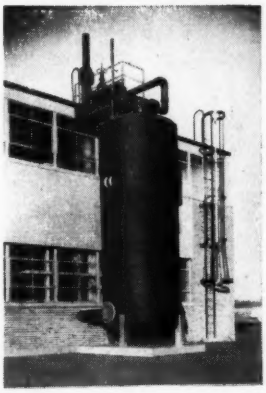
For technical assistance write or call Belco — your first step to lower costs.



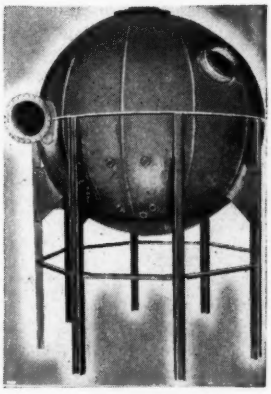
SPRAY TYPE — Belco Deaerator in large eastern oil refinery. Has a capacity of 300,000 lbs/hr.



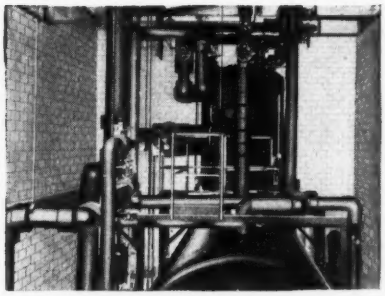
MARINE TYPE—Typical Belco marine heater furnished to shipyards. (Approved by Lloyds of London)



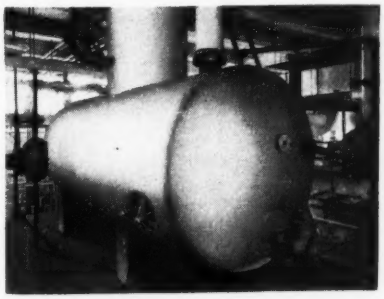
OPEN TYPE—Deaerator at large eastern pharmaceutical plant. Capacity of 80,000 lbs/hr.



VACUUM TYPE — Unit shipped set-up to midwestern utility. Has 150,000 lbs/hr capacity.



SPRAY TRAY TYPE — Belco Deaerator at New York State institution boiler house. Capacity 120,000 lbs/hr.



TRAY TYPE — Belco Deaerator at southern municipality. Has a capacity of 125,000 lbs/hr.

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BELCO DESIGNS, ENGINEERS & FABRICATES WATER PROCESSING EQUIPMENT

Retirement

—Starts on page 49

current earnings) pension program. The unfunded plan need not be qualified with the Treasury if the company does not desire to build up a tax-free reserve. Such a plan can be limited to a much smaller group of employees and provides more flexibility than a funded plan. A company, however, should be careful to watch its future obligations.

A pension also allows flexibility in determining coverage. A plan may be set up covering employees whose compensation exceeds a stipulated amount. But the total of pension plus Social Security must not represent a larger percentage of compensation for the more highly compensated groups than for other groups in the organization.

Some of the most successful plans adopted by small companies have been combinations of the three types of plans described. A few possible combinations are:

a. Pension plan for past service and a profit-sharing plan for future service with the company.

b. Profit-sharing plan superimposed on a pension plan or program.

c. Profit-sharing as an integral part of an unfunded pension.

d. Pension plan and a savings plan.

Should a consulting engineering firm have a retirement program? Can a plan be designed that is flexible enough to meet the many variables and indeterminants common to almost any consulting organization? Will such a program successfully help the employees plan their retirement?

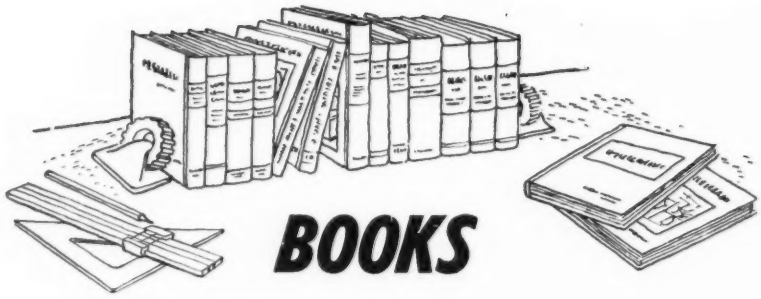
The answer to the first question depends on the situation of the individual firm. As to the second, if past experience can be relied on, one may say that it is possible to design a program to fit the peculiarities of virtually any business.

The extent to which a program helps the employees plan their retirement depends in large part on how successfully it meets the needs of the group. And that in turn depends to a considerable degree on the ability of the employer to define clearly his aims, in the light of the knowledge of his people, the business outlook for his firm, and its competitive position in the field.

Once tentative goals have established, the outside specialist can help work out the details of a plan to achieve them. ▲ ▲

consulting engineers' calendar

Date	Sponsor	Event	Location
Oct. 19	American Institute of Consulting Engineers	Annual Dinner	Waldorf-Astoria New York, N. Y.
Oct. 24-27	American Gear Manufacturers Association	Semi-Annual Meeting	Edgewater Beach Hotel, Chicago, Ill.
Oct. 25-27	American Institute of Electrical Engineers	Machine Tool Conference	Hotel Statler Detroit, Mich.
Oct. 28-29	American Society of Mechanical Engineers—Amer. Inst. of Mining & Metallurgical Engrs.	Joint Fuel Conference	Hotel William Penn Pittsburgh, Pa.
Nov. 1-5	American Welding Society	Fall Meeting	Chicago, Ill.
Nov. 4-6	Air Pollution Control Association	Semi-Annual Technical Conference	Hotel Biltmore Los Angeles, Calif.
Nov. 8	Consulting Engrs. Assoc. of Calif.	Annual Meeting	Ambassador Hotel Los Angeles, Cal.
Nov. 10-12	Industrial Management Society	Management Clinic	Hotel Sherman Chicago, Ill.
Nov. 18-19	National Association of Corrosion Engineers	4th Annual Western Regional Conference	Los Angeles, Calif.
Nov. 23	Manufacturing Chemists Association	4th Semi-Annual Meeting	Hotel Statler New York, N. Y.
Nov. 28-Dec. 3	American Society of Mechanical Engineers	Annual Meeting	Hotel Statler New York, N. Y.
Nov. 29-Dec. 2	1st International Automation Exposition	Exposition	242nd C. A. Armory New York, N. Y.
Dec. 2-7	American Society of Mechanical Engineers	Power Show	Commercial Museum Philadelphia, Pa.
Dec. 12-15	American Institute of Chemical Engineers	Annual Meeting	Hotel Statler New York, N. Y.
Jan. 24-27	Plant Maintenance and Engineering Show	Exhibition and Conference	Int'l. Amphitheater Chicago, Ill.
Jan. 24-28	Amer. Society of Heating & Vent. Engrs.	15th International Exposition	Commercial Museum Philadelphia, Pa.
March 20-23	American Institute of Chemical Engineers	Spring Meeting	Hotel Kentucky Louisville, Ky.
March 23-24	American Society of Mechanical Engineers	Management Conference	Hotel Statler Cleveland, Ohio
May 16-20	National Materials Handling Exposition	Exposition	Int'l. Amphitheater Chicago, Ill.



BOOKS

TO ORDER BOOKS

As a readers' service, CONSULTING ENGINEER will order reviewed books or any other technical volumes you need. In ordering books, give title, author, and publisher and enclose check. We will also suggest titles of books on any technical subject and order for you at regular publishers' prices.

LIGHTNING PROTECTION FOR ELECTRIC SYSTEMS by Edward Beck; McGraw-Hill Book Company; 313 pages; $6.50

Reviewed by H. Carl Bauman
Chemical Construction Corporation

This book should prove a useful tool for all consulting engineers as well as for the electrical engineers who must cope daily with the problem of protecting transmission lines, distribution systems, transformers, and rotating electric machinery. This volume covers a complex electrical art in a smooth reading, almost lay fashion.

A familiar phenomenon since the dawn of mankind, lightning has remained a large mystery until contemporary times. Beck outlines the origin of lightning, factors controlling its severity and frequency of occurrence, and fundamental concepts of protection provided by shielding and lightning arresters.

By deliberately avoiding the more technical and mathematical aspects of the subject (which he has documented with frequent references to the literature), the author has managed to condense into 310 pages the latest knowledge in the art of lightning protection. A well-known authority in this field, Beck has effectively and accurately presented a digest of this specialized art in a complete manner—including latest practices and applicable standards in effect to the date of publication. Liberal use of simple diagrams, condensed tables, and excellent explanatory photographs (most of which are arranged on the same page or facing page of the pertinent text) adds to the effectiveness of the presentation.

A widening field for the application of lightning arresters is resulting from increases in voltage levels and from increasing dollar values represented by installed electrical equipment. Beck introduces the reader to the current and voltage wave forms of lightning, to the measurement of discharges, and to the most recent research. The research of particular importance is that seeking to relate the arresters' abilities to the breakdown characteristics of the protected equipments' insulation. Beck clarifies the fundamental differences between the two basic types of arresters—expulsion type and valve type.

Statistical charts reveal the high degree of reliability in protection afforded against lightning and surges when lightning arresters are properly selected and applied. The author concludes with a chapter on traveling waves. With a minimum use of mathematics he presents clearly and concisely the concept of voltage build-up on lines due to reflections and shows how the proper use of lightning arresters limits this rise to safe values.

Altogether, the book is well written. It provides information about an important technical art to the busy consulting engineer with a minimum of study time.

PROCEEDINGS OF THE INSTRUMENT SOCIETY OF AMERICA, Vol. 8, 1953: Published by the Instrument Society of America; 320 pages; $5.00 to ISA members, $10.00 to nonmembers.

Reviewed by Leo Walter
Consulting Engineer

This volume, the eighth of the series, comprises the sixty-eight papers presented at the Eighth National Conference of the Instrument Society of America; the conference

was held in Chicago from September 21 to 25, 1953.

This volume covers process control, testing, operation, maintenance, analysis, physical properties measurement, production processes, aeronautics, inspection and gauging, transportation, geo-physical and medical instrumentation. A few typical papers show the nature of the process control section; for example, J. E. Barber deals with evaporator control in the food industries. He considers the variables involved: heat input, pressure temperature, liquid level, concentration of final product, and rate of evaporation. Each is analyzed as a separate control unit, although they are inter-related in a complete control system.

Another paper of interest is that by F. W. Velguth and R. C. Anderson on the determination of minimum capacities for control applications. Several arrangements are analyzed for concentration control applications; nomographs are given connecting such variables as concentrations before and after load change, flow rate through plant, tank volumes, and time.

On the measurement side, there is a description of an improved bubble method of measuring specific gravities of starches, a consideration of pneumatic line transmission on a mathematical basis, several articles on computer techniques and strain gauges, and some eleven papers on medical instrumentation.

Papers of special interest to the consulting engineer include "Supervisory Instruments for Steam Turbines" by J. C. Spahr, Westinghouse Electric Corporation; this one deals with supervisory instruments for recording and for warning the operator of abnormal developments. The same subject is covered in a paper by E. P. Uses and R. L. Jackson, General Electric Co. Another is "Human Engineering in Power Plant Instrumentation" by John J. Fleming.

These references have been cited at random, but they give some indication of the range of subjects covered. Though some papers are mathematical in context, the majority make for fairly easy reading.

MODEL ANALYSIS OF STRUCTURES by T. M. Charlton; John Wiley and Sons, Inc.; 142 pages; $5.00.

This book is written for the practicing engineer concerned with the techniques of analyzing engineering structures with linear load deflection. Analysis of such structures by the use of scale models is covered from point of view of the man in the design office who must combine speed with accuracy. Emphasis is placed upon techniques which do not require extensive tools and apparatus. Particular attention is given in the later chapters to the direct methods of analysis that are most amenable to office use.

The sketches are quite clear; they are placed facing the pertinent text. The only shortcoming in illustration is that there is but one photograph of a model; it might have been better to include more photographs of the models.

NUCLEAR REACTORS FOR INDUSTRY AND UNIVERSITIES, edited by Ernest H. Wakefield; Instruments Publishing Co.; 94 pages.

This book is a compilation of articles by seven different authors. Each chapter represents the contribution of one of them. Chapter by chapter, the book covers reactor types, availability, radioactivity measurement, radiation protection, control, instruments, costs, and legal aspects. Perhaps the most singular fault to be found with such a book as this stems from the rapidity with which the atomic energy field progresses. The extensive revisions to the Atomic Energy Act of 1946, enacted by Congress in 1954, makes a good portion of Wakefield's book out-of-date. On the technical side, announcements of great import are made so frequently that the technical basis for the book at hand is quickly antedated; even in the interval between final approval of manuscripts and distribution of the published work there becomes known sufficient information to "date" the book.

Another factor not to be overlooked lies in the peculiarities of the security measures in this technical field. Certainly, the authors were not at liberty to discuss all of the pertinent technical factors that bear on the nuclear reactor picture. So it is that this book might well be a first step in the indoctrination of those seeking information on nuclear reactors. But for those who have been following the field with any diligence this book may prove to be a re-hash of things long past and abandoned.

SIMPLIFIED SITE ENGINEERING FOR ARCHITECTS AND BUILDERS by Harry Parker and John W. MacGuire; John Wiley and Sons, Inc.; 250 pages; $5.00.

Here is a fine working tool for the engineer who must apply the methods of surveying to the establishment of site plans. Beginning with the fundamentals of logarithms and trigonometry, the book goes into a handbook-type treatment of surveying, and concludes with the applications of these principles to the establishment of site plans. The final chapter is comprised of a check list for site plans. Perhaps the only criticism that might be leveled is that the book and its examples are preoccupied with the problems of residential-type construction.

consulting engineer

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